Hearing, vision, and lighting conditions among older recipients of home care

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Det er bedre å tenne et lys enn å forbanne mørket.

-Konfucius-

Summary

Background Hearing and vision impairments and poor indoor lighting conditions in the homes of older persons are risk factors for functional decline, reduced social participation, and accidents. A literature search revealed that few studies have focused on hearing and vision abilities in home-care patients older than 80 years, and on the indoor lighting in their homes.

Aims The main aims of this study were to obtain knowledge about the characteristics of hearing and vision impairments in elderly recipients of home care, and to determine whether there is consistency between self-assessments and standardized tests of hearing and vision in the elderly. Furthermore, the aim was to measure the effects of an intervention designed to improve their functional hearing and vision and the lighting conditions in their homes.

Design and method The study consists of two substudies. Substudy 1 (Papers I and II) had a cross-sectional design in which 93 elderly recipients of home care with a mean age of 89 years were screened for hearing and vision impairments. Paper I was a baseline description of the data on hearing and vision impairments, and Paper II was a Receiver Operating Characteristic Curve analysis used to compare self-assessments of hearing and vision abilities with a gold standard test. Substudy 2 (Paper III) was an exploratory, randomized, controlled trial involving an intervention group (n =46) and a control group (n =47) that tested whether improved indoor lighting, removal of earwax, and referrals to specialists can improve the functional hearing and vision in the elderly (Paper III).

Results Substudy 1 found that 41% of the 93 recipients of home care had slight and 47% had moderate hearing impairments according to the World Health Organization (WHO) measurement scale (1). The mean pure-tone average (PTAV) was 40.4 dB for the better ear in each subject. According to the WHO, the PTAV is $\leq$ 25 dB for normal hearing. The

measurements of visual acuity (VA) found that 40% of the subjects had slightly impaired and 56% had impaired vision according to the WHO measurement scale (2). The mean VA was 0,45 for the better eye in each subject. According to the WHO, the VA is $\geq$ 0.8 for normal vision in the elderly. When the patients were asked to self-assess their hearing and vision function with a single global question ("Do you consider your hearing/vision to be good, not so good, poor or very poor/deaf/blind?"), the results were only weakly correlated with the PTAV and VA measurements. When they were asked about their communication and reading abilities more in detail, however, 72 % admitted it was difficult to understand speech. Nearly 30 % found it tiring to read and 41% could not read very small print (Paper I). Seventeen percent reported having difficulties in performing activities of daily living/instrumental activities of daily living because of hearing and vision impairments. To explore consistency between standardized tests and global self-assessments, we used the cutoff points on the global self-assessment scale of hearing and vision with the corresponding results on the gold-standard tests, which were PTAV $\leq$ 35dB and VA $\geq$ 0.7. Comparison of findings yielded 18 false negatives for hearing, and 40 false negatives for vision. This indicated that a significant proportion of the older people in this study reported their functional hearing and vision as good on the global question when standardized tests indicated that they were not (Paper II). Substudy 2 revealed that the elderly in this study lived in poorly lit environments with lux values far below what is recommended for older people (3). However, the maximum and minimum lighting values were significantly improved in the intervention group after the intervention ($P = 0.02$ and $P = 0.039$, respectively). All participants in the intervention group who were asked to remove their earwax had seen their general practioner and had their earwax removed during the intervention (Paper III).

Conclusion Many elderly recipients of home care live with hearing and vision impairments which have not been sufficiently attended to. Asking elderly people aged 80+ years about

their functional hearing and vision with a single global question will not provide accurate information about their hearing and vision problems. It is necessary to use standardized tests in addition. When asking more detailed questions about their communication and reading abilities, the elderly reported having difficulties. Indoor lighting levels in their homes showed that the lighting levels were far below recommended values, but were significantly improved in the intervention group after the intervention. Many elderly could not be expected to do all the self-care activities necessary to improve their functional sensory impairments and/or the indoor lighting conditions in their homes. Close monitoring and assistance is recommended.

Keywords Sensory impairment, hearing impairment, hearing loss, visual impairment, home lighting conditions, old people, home care, randomized controlled trial, cross sectional study, ROC curve analysis

Forord

Det er mange som skal takkes for å ha bidratt til denne avhandlingen, først og fremst de fem kommunene Hurum, Nedre Eiker, Røyken og Kongsberg i Buskerud, samt Sande i Vestfold, som deltok i studien; lederne som sa ja, de 10 sykepleierne og de to syn- og hørselskontaktene som samlet inn data og ikke minst alle de 100 eldre pasientene i hjemmesykepleien som stilte seg selv til rådighet. I tillegg stilte lysdesigner Mari Sando opp og kartla lysforhold i hjemmene. Tusen takk!

Studien startet med et opplæringsprogram på Papirbredden i Drammen høsten 2011 og hørselsundervisningen ble utført av overlege Hans Kristian Røkenes og audiografene Kristin Lindtvedt og Stine-Mette Jahren fra Drammen Sykehus. Undervisning i syn ble utført av professor emeritus Gunnar Horgen fra IFOS ved Høgskolen i Sørøst-Norge på Kongsberg og lysdesigner Benedicte Nilsen Rauan underviste i lystekniske begreper og belysning i hjemmet til eldre. Spesialpedagog Else Marie Svingen ved Statped kom den siste dagen og underviste i kartleggingsskjemaet (KAS screen) og fortalte om sine erfaringer med kartlegging av eldre med kombinerte syn og hørselstap. Tusen takk til alle!

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“Growing older and taking on the identity of an older person, however, occurs too slowly for us to perceive it directly” Hockey, J. and James, A. (2003) *Social identities across the life course*. New York: Palgrave; p. 41.

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Abbreviations

ADL	Activities of daily living
AUC	Area under the receiver operating curve
CG	Control group
GP	General practitioner
IADL	Instrumental activities of daily living
IG	Intervention group
IPLOS	Individuell Pleie og Omsorgsstatistikk [Individual and Care Statistics]
KAS-Screen	Kombinert Alvorlig Sansesvikt [Combined Serious Sensory Impairment]
LOA study	Lighting Old Age study
Lm	Lumen
LogMAR	Logarithm of the minimum angle of resolution
PTA	Pure-tone audiometry
PTAV	Pure-tone average
ROC	Receiver operating characteristic
VA	Visual acuity

1 INTRODUCTION

This thesis addresses hearing and vision impairments in the elderly[1] and the lighting conditions in their homes. Sensory impairments are a natural part of old age and consequently affect the lives of many elderly people (4-6). Hearing and vision impairments are also risk factors for functional decline reduced social participation, and accidents (7-10). Many elderly never check their hearing, apply for hearing aids or seek professional help for hearing impairments (11-13). It is common for the elderly to not seek specialist eye treatment when their vision weakens, instead purchasing inexpensive ready-made spectacles in nonspecialist retail shops rather than ordering custom-made spectacles (14-16). Increasing age results in less light entering the eye, and this makes the elderly more dependent on good lighting conditions to be able to see (17-19). Several studies have demonstrated that the indoor lighting conditions where elderly people are residing are worse than the recommendations (15, 20-24).

Age-related sensory impairments and eye diseases that frequently occur in the elderly have not received much attention from nurses in the home care sector or from health authorities in general (25, 26). These impairments can sometimes be improved or even remedied by aids, and therefore it is important to detect and address them. There can be underlying illnesses, which are important to detect as early as possible because the time delay before treatment can play an important role in the further exacerbation of certain eye diseases such as glaucoma and age-related macular degeneration (AMD) (14, 27, 28). Even though hearing and vision impairments are a natural part of old age, these impairments do not receive the attention they

[1] There are different traditions for and slightly different perceptions of what is the best term to use for the population investigated in this study. Some will say “elderly” and others will say “older people.” In this dissertation both terms are used. There is no consensus regarding this terminology, and therefore they are used as synonyms.

deserve. It is important to support the elderly in treating such impairments. Sensory impairments can threaten the functioning, well-being, communication ability and quality of life of the elderly (16, 29, 30).

1.1 Relevance of the study

Hearing impairment affects mental functioning (31-34), and both reduced hearing and reduced vision have been reported to increase the likelihood of falls, fractures, dependency, depression, and loneliness (7-9). Hearing and vision impairments represent an additional negative factor for those who already have ailments and chronic diseases, and can represent an unnecessary burden during the last life stages (9, 35-38). Several studies have investigated the decline in sensory abilities and their effects on physical and psychosocial capacities in older individuals (31-34, 39-41). However, most previous studies have involved populations from the general community younger than 80 years, with few studies including older people receiving home care, and few nursing studies examining hearing and vision impairments in this population (16, 25, 42). Nurses play a key role in home care, and they could provide unique opportunities for identifying hearing and vision impairments.

Many older people who are ill and receive home care largely tend to adapt to their situation and accept it as it is (35, 43). Moreover, a significant proportion of patients receiving home care have unrecorded hearing and vision impairments (14, 44-48). A Norwegian survey of lighting conditions in the home involving healthy individuals aged 75 years in 2009, called Lighting Old Age (LOA) study established that many elderly live in homes with insufficient lighting (3, 21, 49). These individuals were largely satisfied with their lives, active, and enjoyed their retirement period. They paid no attention to the need for custom lighting among the elderly (20). Since the present study emanates from the LOA study, it was interesting to

examine hearing and vision impairments and the indoor lighting conditions in an older age group, especially among the elderly who mostly stay at home. The present thesis focuses therefore on hearing and vision impairments and lighting conditions in the homes of persons over 80 years of age who receive home care. The overall aims of this study were to obtain knowledge about the characteristics of hearing and vision impairments in elderly recipients of home care and to determine whether there is consistency between self-assessments and standardized tests of hearing and vision in the elderly. Furthermore, the aim was to measure the effects of an intervention designed to improve their functional hearing and vision and the lighting conditions in their homes.

2 BACKGROUND

Normal age-related changes in hearing and vision mean that most people will experience increasingly impaired hearing and vision function as they grow older (27, 50). Age-related declines in all sensory modalities including hearing, vision, smell, taste, touch, and pain have frequently been reported (51-53). Knowledge of this process is essential for the awareness and understanding of the difficulties that older people with sensory impairments often experience, and it is important that nurses providing home care know what the normal changes are and what changes could be an underlying disease.

2.1 Hearing

Age-related hearing impairment is described only briefly here, since the pathophysiology, risk factors, and treatments for age-related impairments and diseases of the ear are beyond the scope of this thesis.

2.1.1 Presbyacusis and age-related hearing impairment

Age-related hearing impairment (presbyacusis) is characterized by reduced hearing sensitivity and speech understanding in noisy environments, and an impaired ability to localize sound sources (51, 54). With increasing age, calcification may occur in the bone-structures of the ear and also in the ring structure supporting the eardrum, which reduces its elasticity and thereby its motion (55, 56). The cochlea is the organ in which sound is converted into the electrical signals that are sent to the brain, and the transducing hair cells of the cochlea are progressively lost with advancing age (14, 27, 50, 55), particularly in the area where high frequencies are encoded, which impacts the ability to perceive high-frequency sounds (50, 56, 57). The loss of outer hair cells causes the basilar membrane to vibrate less, and cell loss in

the auditory nerve interferes with the neutral basis for sound perception (28, 55). Hearing sensitivity is closely associated with the ability to hear certain consonants such as “s,” “sh,” “f,” “v,” “t,” “p,” and “b,” whose energy is concentrated at frequencies from 2000 to 8000 Hz (27, 56, 57) (see Figure 1, which includes the “speech banana” indicating the predominant location of speech sounds).

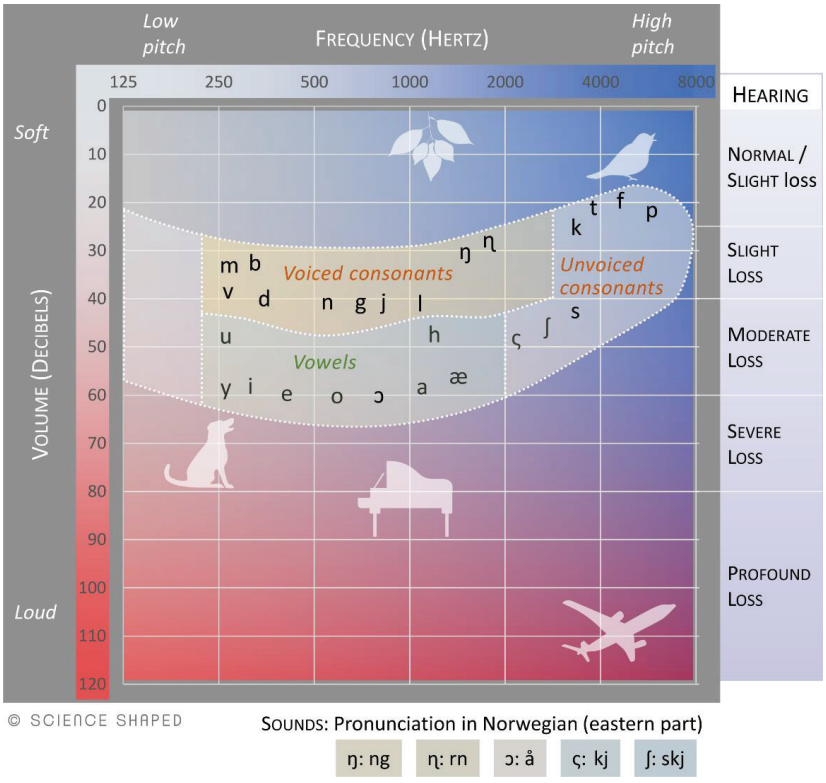

Figure 1 Audiogram with speech banana indicated (for normal speech at 1 m)

The perception of sound is influenced both by how the incoming information is processed and by the mechanisms that regulate perception and cognition. The perception of speech is dependent on the acoustic characteristics of words, sentence construction, and even the social framework, so language perception presupposes both adequate sensory analysis and

understanding the rules for linguistic structures (55, 56). Sounds of different frequencies are registered by different sensory hair cells along the basilar membrane, and so when these sounds appear simultaneously or very close to each other, this affects the perception of the sound and can make it difficult for the listener to distinguish between them (55, 58). However, it is important to distinguish between difficulties related to failure of the sensory apparatus and cognitive deficits (55). The weakest sounds that can be perceived at different frequencies are expressed in an audiogram, an example of which is shown in Figure 2.

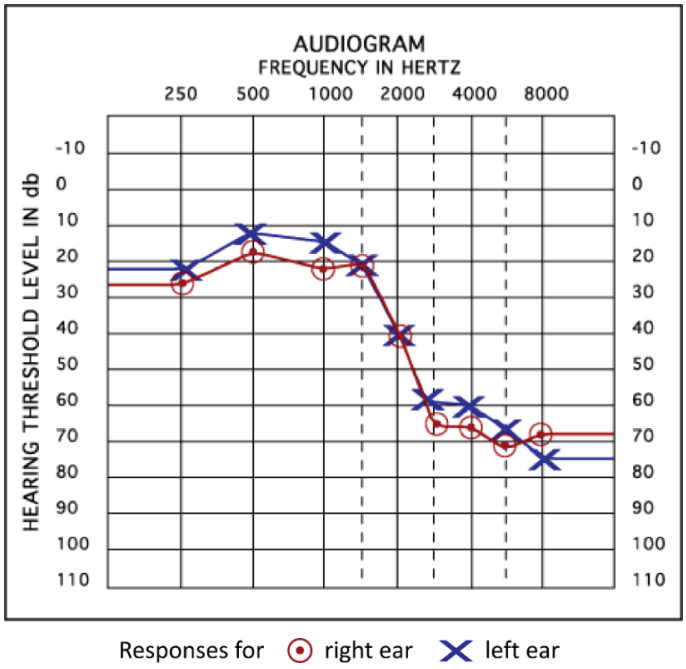

Figure 2 An example audiogram

Age-related hearing impairment normally occurs first at higher frequencies, as shown in Figure 2 (56). The estimation of age related hearing impairment is categorized by air-

conduction thresholds, usually at frequencies of 500, 1000, 2000 and 4000 Hz[2] (1, 14). The thresholds at higher frequencies typically increase throughout life, but especially from around 70 years of age, and those at speech-related frequencies tend to increase more rapidly from 50 to 90 years of age (50, 55, 56). However, the elderly might simply adapt to progressive deterioration in their hearing function, resulting in them do not noticing the changes themselves (19). Some elderly may also experience other types of difficulty when their hearing function is impaired (59-61). Wearing spectacles is more socially acceptable than using a hearing aid, and many elderly people do not like to admit that they have a hearing problem (51). Some elderly also underestimate their hearing impairment thinking that their hearing is better than it actually is. Hearing impairment is also associated with depression, anxiety, and insecurity (51). It can lead to misunderstandings, suspicion, and social isolation (19, 62), and thus it is important for nurses providing primary health care to be aware of the problems experienced by the elderly due to hearing impairments.

2.1.2 Functional hearing

This study focused primarily on what we call "functional hearing". As highlighted above, age-related hearing impairment is common in old age, and this condition is usually nonreversible. The goal in this study was to improve the functional hearing of old people in his/her daily lives. This implies that the intervention should address factors that could safeguard most of the remaining hearing function by removing hearing-impeding factors and increase hearing-supporting conditions.

[2] Age-related hearing impairment also occurs at other frequencies. WHO recommends using these four frequencies to represent the impairment across the audio frequency spectrum, but there are also other recommendations..

2.2 Vision

Age-related vision impairment is described only briefly here since as for hearing, the pathophysiology, risk factors and treatments for age-related impairments and diseases of the eye are beyond the scope of this thesis.

2.2.1 Presbyopia and age-related vision impairment

Normal age-related changes in the vision system mean that most people experience increasingly altered or impaired vision as they grow older (27, 50, 63, 64). The pupil becomes smaller with age, which reduces the amount of light entering the eye, the lens thickens, gets stiffer, and is less able to accommodate, and the ciliary muscle weakens (56, 63). These changes, which make it difficult to see sharply at close range, are called presbyopia and lead to the need to use reading spectacles (56, 63). The need for prescription spectacles also increases with age (16, 65), and depth perception and color vision also change (18, 56). These changes are often apparent from about 40 years of age, when many people first need to use reading spectacles (19, 66). After 65 years of age, the loss of retinal cells and the associated reduction in the acuity of the visual field can result in reduced night vision and other impairments (17, 67). These age-related changes mean that the retinas of those 60- and 85-years receive about approximately one-third and one-fifth, respectively, of the light than a 20-year old retinas receives (15, 17, 18, 68). When an elderly person walks into a dark room after being outside in bright sunlight, he or she can experience problems with depth perception and distance assessment before the eyes have adjusted to the reduced lighting conditions. The aging eye also exhibits increased sensitivity to bright light and a loss of contrast sensitivity (17, 63). Other age-related problems include the lens gradually losing its transparency and becoming more yellow. The yellowing of the lens results in the blue portion of the light spectrum being absorbed and hence filtered out (18, 69). A lens with reduced transparency

increases the risk of glare due to the light rays being refracted unevenly and becoming diffusely distributed on the retina. This glare effect is comparable to the effect of the sun shining on a dirty car windscreen, and it can cause great discomfort (15, 18). The wrinkles that form around the eyes and sagging muscles of the eyelids, together with reductions in adipose tissue and elastic binding tissue in the skin around the eyes, may lead to a condition called ectropion, in which tear ducts can clog and become irritated, which can feel like itching or burning, or "sand in the eye" (63). Many elderly people can also develop diseases such as AMD, conjunctivitis, cataracts, and glaucoma (14, 17, 27, 28).

The visual angle crucially determines the size of an image on the retina. The smallest angle under which an object can be seen is limited by the spatial resolution of the retina, which is mainly determined by the size of the cones and the distance between them (70). For example, when a person looks at two points separated by an angle of one minute of arc ($\nu = 1'$) and can just perceive the two points as being separated, he/she has normal visual acuity (VA) = 1. VA is the reciprocal value of the viewing angle measured in arc minutes: VA = 1/v (visual angle in minutes of arc; see Figure 3), which is the basis for understanding the LogMAR (logarithm of the minimum angle of resolution) chart.

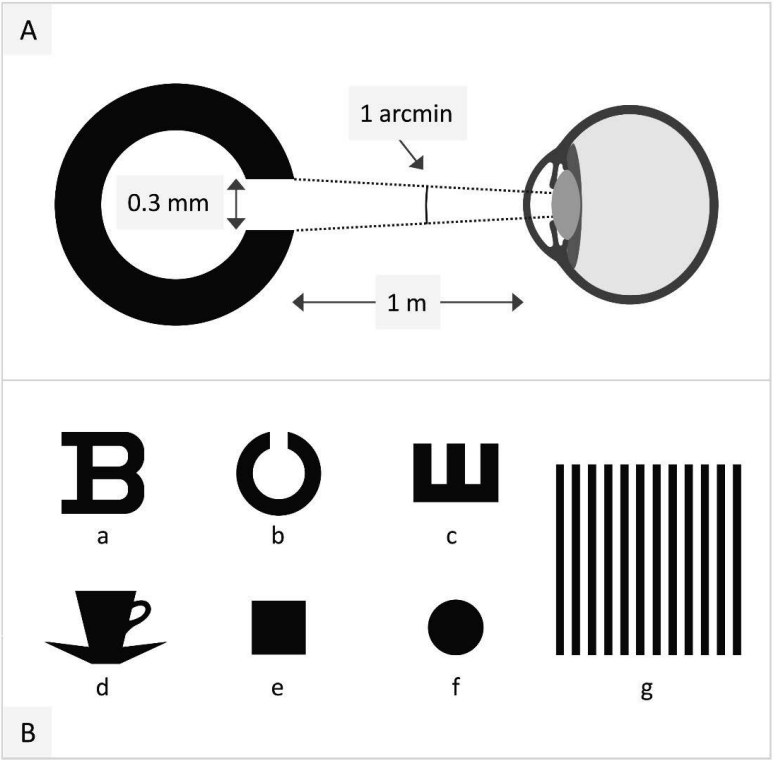

Figure 3 Visual acuity in arc minutes

Normal VA is designated as Snellen 6/6 (or 20/20 in the English measurement system)**,** where the numerator denotes how far the person is from the chart in meters (or feet), and the denominator is the distance at which a person with normal VA would discern the same optotype (obviously also 6 m in this case). For example, a person with 6/12 vision would only discern the letters for 12 m at 6 meters testing distance. Several countries use decimals to indicate VA instead of mathematical fractions (e.g., 6/6 = 1.0 and 6/12 = 0.5).

2.2.2 Functional vision

This study focused primarily on what we call "functional vision". As highlighted above, age-related vision impairment is common in old age, and like hearing impairment, this condition is usually nonreversible. Many eye diseases in old age cannot be cured (unlike cataracts, which is an operable condition), although medical treatment can hinder further progression and/or reduce its impact in terms of eyesight in daily life. The goal in this study was to improve the functional vision of the elderly, which implies that the intervention needed to address factors/conditions that could safeguard most of the remaining visual ability by removing visual-impeding factors and increase visual-supporting conditions.

2.3 Light and lighting conditions

Light is energy in the electromagnetic spectrum at wavelengths between 380 to 780 nm, and its intensity is quantified in lumen (Lm). The illuminance in a room relates to the amount of light falling on a surface, and is measured in lux and indicated with the letter E. The lux and lumen are related by $E = Lm/m^2$, see Figure 4.

One lumen is defined as 1 watt of electromagnetic energy at a wavelength of 555 nm wavelength × 680; that is, $\Phi_{555} = 680 \times \Phi_{e555}$ for λ=555 nm, where Φ_{555} is light flux in lumen and Φ_{e555} is the effect of radiation in watts at wavelength = 555 nm (17, 71). The figure 680 is an historic constant[3] (17). The wavelength that the eye is maximally sensitive to depends on the lighting condition. In daylight the eye is most sensitive to light with a wavelength of 555

[3] The conversion figure 683 from physics is historically determined because the two systems developed independently. The relationship between them was discovered later. The connection between the physical and the photometric system is now that the radiation power of 1 W with wavelength λ=555nm is equal to one luminous flux of 683 lumen.

nm (approximately yellow), whereas at lower illumination levels the maximum sensitivity shifts to 505 nm (approximately green) (18).

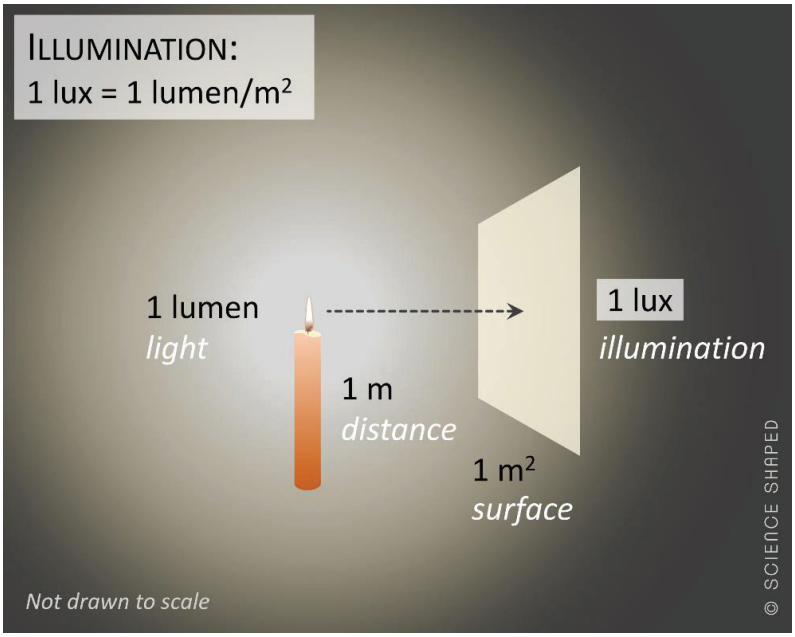

Figure 4 Illuminance measured in lux

Impaired vision and impairment in the vision system mean that elderly people need more light, customized lighting, and specially adjusted lighting conditions in their homes (72, 73). Exposure to daylight is also important, even when people are indoors. In Norwegian building code, good practice originally specified that the window area in a living room should be equal to at least one-tenth of the floor area of the room, with at least one of the windows in the room reaching down to 1 m above the floor (18, 74). However, since daylight can also cause glare, achieving good visibility and lighting condition in a room requires sufficient control over reflection, glare, brightness consistency, and perceived color (18, 71, 75). The eye adjusts to the overall lighting in the visual field, so large variations in illumination in a room will result in the eye being poorly adapted to the brightest and dimmest areas (18, 71). Color perception

is influenced most by the incident light, and the materials and patterns of the reflecting surfaces (71). Moreover, the perception of size is influenced by color, in that a light surface appears larger than a dark one (17).

2.4 Screening of hearing, vision and lighting conditions

Nurses and/or other personnel involved in primary health care mostly use patient self-assessments to determine the need for referrals to specialists (16, 54, 76). For the present study there was a special agreement with a specialist center that allowed the nurses participating in this study to make referrals. Common questions used for the self-assessment of hearing are "Do you have a hearing problem now?" and "How do you rate your hearing on a scale from excellent, very good, good, fair or poor?" (76-78). Many vision tests consist of a single global question "In general, would you say your vision is excellent, very good, good, fair or poor or "Do you have any difficulties seeing, even when wearing your glasses?" (79, 80).

Pure-tone audiometry (PTA) tests performed by presenting individual tones with frequencies (Hz) of 500, 1000, 2000 and 4000 Hz at various intensities, are recognized by the World Health Organization (WHO) as a standard formal assessment of hearing (1).

VA testing using a LogMAR chart is recognized as the gold standard for a formal assessment of visual function (81-84). The systematic screening for vision impairment and measuring the lighting conditions in the homes of the elderly is almost nonexistent in the home care, and is entirely trusted to the private sector. Only when people have severe visual impairment, might they be able to get help from an aid center in their county to measure and improve their lighting conditions.

In this study, functional hearing and vision were measured using standardized instruments and by asking the participants to self-assess their hearing and vision based on a single global question ("Do you consider your hearing/vision to be good, not so good, poor or very poor/deaf/blind?"). In addition, they were asked to self-assess their communication and reading abilities using more detailed questions from the KAS-Screen (Kombinert Alvorlig Sansesvikt [Combined Serious Sensory Impairment])..

2.5 Self-care

Maintaining the function of the senses, especially hearing and vision, is considered to be essential for a safe, meaningful, and rich life into old age (85). One of the assumptions made in the present study was that it would be in the interests of the elderly to follow advice about how to improve their functional hearing and vision, and to enhance the lighting conditions in the home, since this would facilitate daily functioning, communication and reading, and safeguard their home. This could include advice about visiting a hearing or eye specialist, or about improving the lighting conditions in the home.

The concept of self-care was introduced in nursing already in the late 1950s by Virginia Henderson (86, 87). Since then this concept has been defined and interpreted in the literature in different ways (88-93). A lack of consensus still seems to exist (94), with the research performed prior to 1989 focusing primarily on medical self-care, which was considered supplementary to professional health care rather than as a health-promoting approach in health care in its own right (94).

Today, the concept of self-care is mainly understood in the nursing field through Orem's Self-Care Deficit Theory of Nursing (95, 96). She defines self-care as "The practice of activities that individuals initiate and perform on their behalf in maintaining life, health and well-being"

[p. 43of (95)]. Orem et al (96) view human beings as being in need of continuous self-maintenance and self-regulation through self-care. When the level of self-maintenance is insufficient for maintaining life, health, and well-being, the person requires knowledge and skills to perform self-care, or else a nursing intervention (95). An assumption underlying this theory is that each person cares for himself/herself to the best of their ability, but there can be an imbalance between self-care needs and abilities, particularly when the health state deteriorates or illness is present. Such cases normally require a nursing intervention or some sort of informal care provided by the family or others in the person's social network (95). It is the self-care ability, [i.e. having the confidence, knowledge, and skills to perform the self-care activities necessary to reach a desired goal (97)], that determine whether or not knowledge and skills are actually employed to execute a course of action successfully (98).

There have been many studies of self-care from a nursing perspective, especially in the field of chronic diseases (99), but there has been less focus on the significance of the concept as a health resource for the elderly. Some of the studies investigating the self-care ability of home-dwelling elderly, both in urban and rural areas, have found that physical activity and mental capacity are important factors for explaining the self-care ability of the oldest old (100-103). Even if age-related sensory impairment is not considered a chronic disease, many of the methods used for dealing with chronic diseases could be applied. Loriq and Holman (104) stressed that once a chronic disease is present, one cannot NOT manage, the only question is how, and this statement is also relevant to hearing and vision impairments. Methods of coping with hearing or vision impairments need to be found, which could mean changes in habits such as using spectacles or a hearing aid, and changes in the home environment.

In this thesis, self-care refers to the tasks or actions that a person with age-related hearing and/or vision impairment must perform to safeguard and enhance their functional hearing and

vision when performing normal activities of daily living. These tasks may include having earwax removed, visiting a specialist, applying for a hearing aid, buying new custom-made spectacles, or enhancing the lighting level, buying new lamps, or installing a lighting control system to improve lighting conditions in the home (105).

2.5.1 The home

Our home is considered the framework for our lives and a symbol of family, status and taste for the person living there (106). Lewin (107) suggests that the home is for the soul, and Board (108) considers that it has a mystical meaning that can make the ordinary extraordinary. The home and what it means have also been a key concept in literature, poems, and music (108). Després (109) explains how individuals mark their home as a way of demonstrating identity, of feeling secure and exerting control. According to the Norwegian social anthropologist Marianne Gullestad (110), the very strong symbolic value of the home makes it a condensed symbol for important values in our lives. The home is a private arena, and Gullestad (110) argues that the distinction between the private and the public is linked to the home. Having a home is also about belonging, and about having an anchor or an attachment for the integration of daily impressions and experiences (111). Because the home is central to the identity of its inhabitants, its design plays an essential role in building and preserving identity (110).

The above-mentioned factors are important to consider in the context of the present study, where the participants may be advised to make changes concerning their lighting conditions.

The home provides a type of freedom, in that people can live their lives at home the way they want to (112). Although the meaning of the home changes throughout the life course (113), the ability to continuing to live at home provides security, individual authority, and

empowerment and it is important that this is respected and supported by home-care nurses (106). Askham (114) discovered that many older people are very attached to their homes, and that they benefit from being familiar with the local environment and services such as shops and the local doctor. Iwarsson (115) found that the home environment is significant for providing a sense of well-being and independence among octogenarians, despite their declining health. In the present study, where the intervention took place in the own homes of the elderly, it was important to safeguard their well-being and respect their right to make decisions in their own homes. However, the home environment including the lighting conditions is important because the home is where the elderly recipients of home care spend most of their time. An important issue in the study was thus to have an open dialogue with the participants.

2.5.2 Home care

Living at home and receiving home care is being increasingly seen worldwide as being preferable to institutional care for older persons in need of care (116-118). This means that a functional home adapted to meet future challenges in different phases of life is a shared goal for both the elderly and the authorities (119). Since there is evidence that participating in meaningful activities increases the likelihood of the elderly experiencing a good life (120, 121), adaptation of the environment, including the home, seems to be important for facilitating the social interactions and communication of the elderly with their friends and families (122). It is thus a goal for the home-care services in Norway to facilitate health-promoting and disease-preventing initiatives among both individuals and the wider community.

Home care is a municipal service that involves providing care to patients in their own homes. Laws, guidelines, and other regulations administered by the Norwegian Ministry of Health

and Care services and the Norwegian Health Directorate regulate the provision of care for the elderly in Norwegian municipalities (123). The 2012 Coordination Reform emphasized the need for increased collaboration between different community sectors, levels, and professions, as well as increased attention to health promotion and disease prevention (124, 125).

Age-related hearing and vision impairments and the requirements of indoor lighting conditions in the home have not traditionally been considered as basic needs, and have for the most part been addressed by the private sector, by the elderly themselves, and with the help of their families. However, in the future, when the prevalence of the elderly living at home is likely to increase (126, 127), it might be preferable to implement interventions for detecting age-related sensory impairments and inadequate indoor lighting conditions as part of the measures for promoting health provided by community health-care services. This will further increase the importance of the home environment.

Nurses play a central role in caring for the elderly, but other health professionals are also involved in the provision of home care (118). Each county in Norway has an aid center for ameliorating hearing and vision impairments, and for ensuring adequate indoor-lighting conditions for persons with severe vision impairments (128). Professionals employed by the centers make formal decisions in accordance with the applicable laws about who will receive aid and what aid they will receive from aid centers (129). People working for the home-care services fill out the application forms for the aid that is required, and they are responsible for the follow-up. Each municipality in Norway is recommended to have a specific contact person for hearing and vision impairments (130), but this is not a mandatory requirement and these contact persons do not provide preventative services. The hearing or vision contact

person sees the patient only after he/she or a family member has identified a serious impairment.

The hearing and vision of the elderly living in their own homes for as long as possible is in this thesis also linked to risk management. In this regard, the home has effectively been given a new status. Characteristics of the home environment, such as good lighting conditions, are important for maintaining health and preventing accidents such as stumbling and falling, and this needs to receive sufficient attention. This aspect may highlight an educational role of nurses and the pedagogic aspect of preventing accidents and promoting health (95). However, these considerations are fundamentally affected by the extent to which it is desirable to intervene in a private sphere such as the home. Important focuses in this study were therefore self-care and the autonomy of the elderly.

With the aim of ensuring the quality of home care, Norwegian municipalities have since 2007 been required to use the IPLOS documentation system when registering persons needing health care (131). The IPLOS registration form contains a global question asking the patient to self-assess his/her hearing and vision (Appendix I), which in this situation is simply asked by the nurse who is performing the registration.

2.6 Summary of existing knowledge and background for current research

It is well known that there is an age related decline in all sensory modalities including hearing, vision, taste, smell, touch and pain (52, 53). Several papers deal with the prevalence of hearing and vision impairment in large populations (132, 133) and the consequences of age related hearing and vision impairment (9, 38, 48, 134-136).

Few studies have examined the impairment of functional hearing and vision in people who are 80 years and above in a home care setting. Since this is a vulnerable group because of their advanced age and health condition, it is essential to know the prevalence of hearing and vision impairments. It is common in Norway and other countries to routinely ask the elderly in the home care setting to self-assess their hearing and vision. We wanted to investigate whether the self-assessment is a sufficient assessment to determine the functional hearing and/or vision among the elderly (age 80+ years) recipients of home care.

It is well known that light is a significant factor when evaluating the vision function in the elderly (137-140). Light is identified as an important environmental attribute to affect the vision (24, 141-144). Both mental and physical health are affected by the light surrounding us (22, 145-147). The circadian rhythm is regulated by the light, also for older persons (148). In Norway and other countries with large seasonal variations in daylight hours, this means that during the winter period, from October to February, it is dark outside for most of the waking hours. It is vital for the elderly to be independent and able to care for themselves as long as possible. It is important that we do all we can to enable the elderly to have the best quality of life possible for the last part of their life. A literature search identified only two previous intervention studies investigating lighting conditions in the homes of the elderly with low vision (23, 149), indicating the importance of investigating this field. We wanted to try out an intervention where recipients of home care older than 80 years were offered advice on how to improve their functional hearing and vision and to implement better lighting conditions in their homes.

3 AIMS AND RESEARCH QUESTIONS

The overall aims of this thesis were to obtain knowledge about the characteristics of hearing and vision impairments, to determine whether there is consistency between self-assessments and standardized tests of hearing and vision in the elderly, and to measure the effects of an intervention aimed at improving their functional hearing and vision, and the lighting conditions in their homes.

One of the assumptions in the study was that persons older than 80 years of age and living in a home care situation could be suffering from uncorrected hearing and vision impairments, and that their homes were insufficiently lit, resulting in light levels below the recommended Norwegian lux values (3). It was hypothesized that after a 10-week intervention period, the patients in the intervention group (IG) would have improved their functional hearing and vision compared to those in the control group (CG) through corrective means in daily life, such as by using new spectacles and new hearing aids, the removal of earwax, and/or enhancing the indoor lighting conditions. A simplified strength calculation, in which it was assumed that a difference in light level of 20 lux could be detected with a probability of 0.90, showed that 100 patients were needed in 2 groups, the IG and the CG, with 50 participants in each group.

The specific aims and research questions addressed in the two substudies constituting this study and the associated three papers are presented in Table 1.

Table 1 Overview of the aims and research questions of the substudies and papers

Sub-study	Paper number and title		Aim	Research questions/hypothesis
1	I	Sensory impairments in community health care: a descriptive study of hearing and vision among elderly Norwegians living at home	Describe the hearing and vision function of a population aged 80+ years that receives home care.	What characterizes hearing and vision among those aged 80+ years receiving home care? Do the results from the standardized tests match the patients' self-assessment of the two sensory functions? How do sensory impairments affect verbal communications and reading in daily life?
	II	Discrepancy between self-assessed and standardised tests of vision and hearing among the elderly living at home: an ROC curve analysis	Determine whether there is consistency between self-assessments and standardized tests of hearing and vision in the elderly	Is there a consistency between global self-assessment of hearing and vision and scores on standardized tests of hearing and vision?
2	III	An intervention designed to improve sensory impairments in the elderly and indoor lighting in their homes: an exploratory randomized controlled trial	Elucidate any changes in vision, hearing, and lighting conditions in the home following a clinical intervention	It was hypothesized that after 10-weeks the patients in the IG would have improved functional hearing and vision and enhanced indoor lighting in the homes compared to the CG.

4 STUDY DESIGN AND METHOD

The work performed for this thesis consisted of two substudies. Substudy 1 had a cross sectional design in which 93 out of 100 recruited elderly recipients of home care, who satisfied the inclusion criteria, were screened for hearing and vision impairments. Substudy 2 had a randomized, controlled, experimental design that tested whether advice about increased and facilitated indoor lighting, removal of earwax, and referrals to specialists could improve the functional hearing and vision of the elderly recipients of home care. The testing tools consisted of simple screening tests for hearing and vision and recording the light levels in the living room of the home. An overview of the study is presented in Figure 5.

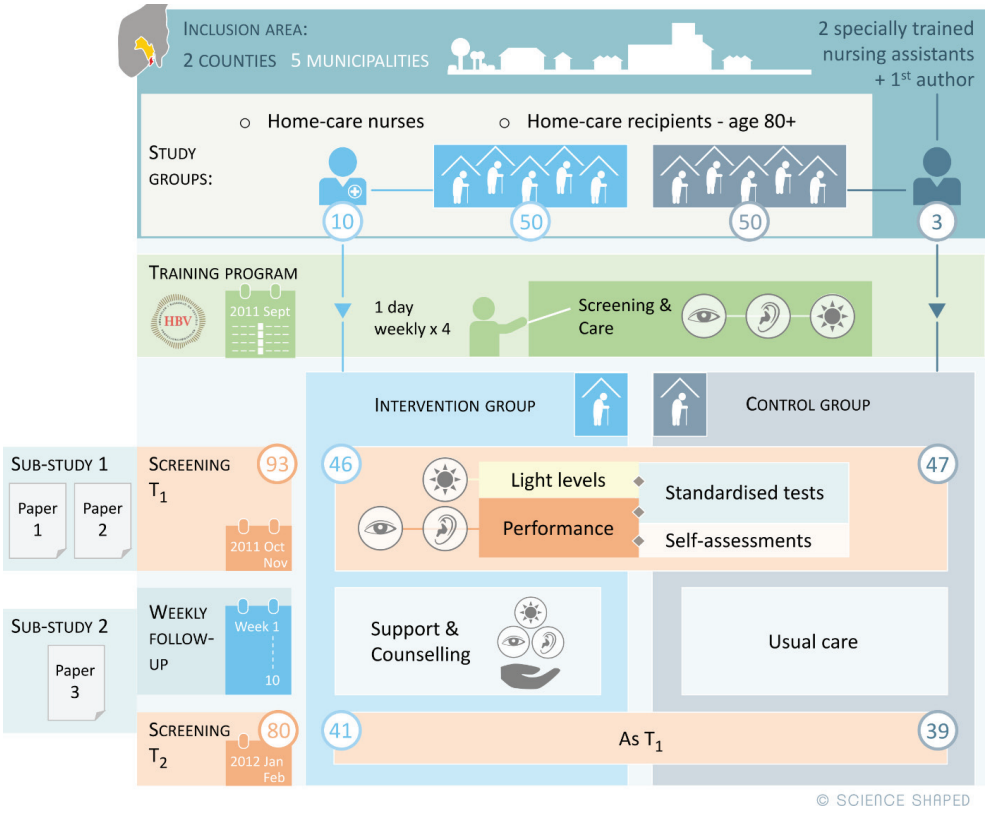

Figure 5 Overview of the study

4.1 Setting

Five municipalities (comprising four rural areas and one town, with populations ranging from 9.000 to 26.500) located in two counties in the central southeast of Norway participated in both substudies. A hearing center and eye specialists were located within a 1-hour drive of the home for all participants, and there were opticians in each municipality.

4.2 Sampling home-care nurses

Contact was established with the relevant local authorities and the current leader of the home care services in the five municipalities which were requested to participate in the study. The service leader was informed about the purpose of the study, the application method and practical considerations. Each leader was asked to recruit two participants from their municipality who had an interest in the study topic, giving ten nurses in all. The inclusion criteria were being registered nurses and working in home-care services.

4.3 Recruitment, sampling, and randomization of patients

The procedure used to recruit patients for Substudy 1 simultaneously encompassed the randomization of the participants for inclusion in Substudy 2. Thus, the same sample of patients was involved in both substudies, with only the sample in Substudy 2 being divided into the IG and CG. The home-care patients were recruited during September 2011, while the nurses attended a training course.

The inclusion criteria were being ≥80 years old, receiving home care, and able to speak Norwegian. The exclusion criteria were presence of dementia, cognitive impairment, or very serious illness. The person could be living alone or with a spouse/partner, and there was no

constraint on the length of time that the person had received home care before the study started.

In total 100 patients (20 in each municipality) who met the inclusion criteria were recruited by 2 nurses and the leader in each municipality who identified the different districts where these 2 nurses worked. A prerequisite for the study was that the investigations should be carried out as part of the daily work of the nurses. This meant that the patients had to be recruited from the districts where the ten study nurses worked, which did not cover all of the districts in the municipalities. This affected the statistical generalizability of the results since they did not comprise data from the whole of the municipality. Each attending district was assigned a number, and a random draw determined which districts were to be part of the IG and CG. The two nurses and the leader then identified all of the patients who satisfied the inclusion criteria in the districts from the first draw. A second draw of 10 patients from each district decided which patients were assigned to each group. The patients who were drawn were asked to participate in the study, and those who expressed a willingness to participate were given information about the study, and then asked to sign a consent form.

The 100 patients recruited comprised the total sample for Substudy 1. The sample in Substudy 2 comprised the same participants as in Substudy 1, but the participants were randomized into the IG and the CG during the recruitment procedure.

Before the first screening (T_1), which was conducted during October and November 2011, and during data collection at T_1, four participants had died (one from the IG and three from the CG), and three were admitted to hospital (all from the IG). The final sample in Substudy 1 thus comprised 93 participants (72 females and 21 males) at T_1, and the same sample in Substudy 2 consisted of 46 participants in the IG (38 females and 8 males) and 47 in the CG (34 females and 13 males) at T_1.

During the 10-week intervention period and the second screening (T_2), which was conducted during January and February 2012, six participants had withdrawn (two from the IG and four from the CG), four had died (two in each group), and three had been admitted to hospital (one in the IG and two in the CG). Thus, the final number of participants in Substudy 2 at T_2 was 41 in the IG (34 females and 7 males) and 39 in the CG (29 females and 10 males) (Figure 6).

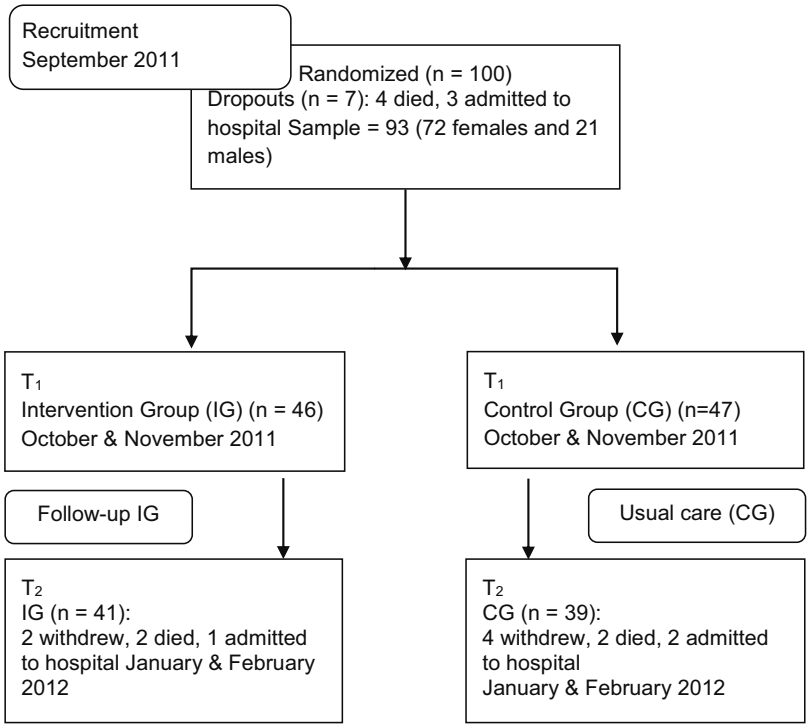

Figure 6 Flow diagram of the study

4.4 Training program

A special training program was applied to the 10 nurses who screened and performed the intervention for the IG in Substudy 2 and also screened these participants in Substudy 1. Two additional specially trained nursing assistants in hearing and vision from two of the

municipalities also participated in the training program. These two nursing assistants together with the present author performed the screening of the CG in Substudy 2 and screened these participants in Substudy 1.

External experts in hearing, vision and lighting design provided the training at the University College over 4 days (1 day per week) in September 2011. The training program consisted of theoretical and practical sessions as well as a thorough review of the instruments used for the screening in both substudies at T_1 and T_2. The training program is presented in Table 2.

Table 2 Training program

Day 1: Hearing	**Day 2: Vision**	**Day 3: Lighting**	**Day 4: Instruments**
Distribution of relevant literature and screening instruments			
Morning session: The human ear and hearing function, age related hearing impairment, patient history, injuries, noise damage, mechanical and neurological limitations and the production of ear-wax, functional hearing	Morning session: The human eye and vision function, current theories and concepts, dark adaptation, ametropia/refractive errors, diseases of the eye, presbyopia, and age-related vision impairment, functional vision	Morning session: Theory of light, photometric concepts, how light affects humans, light perception and old age, different lighting control systems, different types of light bulbs (including fluorescent lamps, and LEDs) and other light sources, and recommended light levels for older people	Morning session: Self-assessment tests using the KAS-Screen, recording of demographic data using the KAS-Screen, follow-up procedures of the intervention for Sub-study 2, maintenance of hearing aids and familiarization with the use of hearing aids, and cleaning and maintenance of spectacles
Afternoon session: Diagnostic testing, tuning-fork test, PTA and PTAV*, otoscopy, sound pressure level and hearing level, vowels and consonants, communication with hearing impaired persons, importance of light, and hearing aids	Afternoon session: Clinical procedures, ocular measurements and examinations, practical tests of: VA, Snellen and LogMAR, stereo acuity (fly test), visual field test (Donders method), importance of light, spectacles and vision aids	Afternoon session: Light measurements (in lux) and the use of the light measuring instruments, measuring the max. and min. lux values, calculation of the average lux values in a room, and registration of lamps, windows and other conditions affecting the light in a room	Afternoon session: Review of all of the instruments, repetition of the practical tests, and questions- and-answer session

*PTAV = pure-tone average

Simple standardized screening procedures and screening tests for hearing and vision and for measuring the lux values in the living room were prepared. The KAS- Screen instrument (11) was used to examine self-assessments of hearing and vision by the elderly and their impact on daily life. A form was developed for documenting the lighting conditions and the measurements of hearing and vision. The theory sessions were videotaped and made available for the participants to review. For Substudy 2, the nurses were trained in procedures for following up the IG participants. Time was set aside to discuss various problems that might arise and the importance of communicating with the elderly.

4.4.1 Instruments

The instruments used in the two substudies yielded data on hearing and vision as well as lighting-conditions in the homes of the elderly, and on self-assessment with a screening instrument (KAS-Screen), Table 3 and Figure 7.

Table 3 Instruments used and measured variables in both substudies

Sub-study	Papers	Instruments	Assessed variables	Comments
1	I, II, III	Heine Mini 3000 otoscope and Sennheiser HAD-2 manual portable pure-tone audiometer	Earwax, eardrum and PTAV at 500, 1000, 2000, and 4000 Hz (WHO M4 recommendation)	PTAV measured on a logarithmic scale according to the WHO M4 recommendation
	I, II, III	LogMAR chart	VA	Bailey-Lovie LogMARdistance acuity chart
	I, II, III	KAS-Screen	Screening instrument with 110 questions, from which 16 questions about how hearing and vision influence the daily life of the participants were selected	The questions are referred to in parentheses in Tables 3, 5, 7, and 8 [e.g., (q1), (q16)]
2	III	Nurse logbooks	Reflections, comments, and observations	The nurses maintained a logbook to enter reactions, comments, and observations
	III	Hagner luxmeter	Minimum, maximum, and average room light levels, and reading lights were measured	Light values in the living room and of reading light

Figure 7 Instruments used in the study

Heine Mini 3000 otoscope

The ear was inspected for earwax, and a Heine Mini 3000 otoscope was used to examine the eardrum.

Pure-tone audiometry

PTA was conducted in accordance with the modified Hughson-Westlake ascending technique, as specified in EN ISO 8253-1:2010, using an Entomed SA201-IV portable manual audiometer equipped with Sennheiser HDA200 circumaural earphones. Audiometric thresholds were established separately for the left and right ears using the M4 recommendation of the WHO, which specifies the sensitivity at 500, 1000, 2000 and 4000 Hz, in order to estimate the mean hearing impairment at these frequencies (150), which corresponds to the pure-tone average (PTAV). The severity of hearing impairment in the better ear was quantified in accordance with M4 recommendation as follows[4] (2): $\leq$25d, 25-40, 41-60, 61-80 and > 80dB were categorized as no or very slight impairment, slight, moderate, severe, and profound hearing impairments, respectively (151). A hearing impairment of > 40dB is considered to be a disabling hearing impairment (150, 151). The

[4] A new (2016) version of the WHO classification scale of hearing impairment has arrived since the papers (articles) were written. The only change in this new version is that a hearing impairment of 25-40 dB is now called slight instead of light impairment.

cutoff and gold standard was set to be PTAV=35dB. The PTA is a standardized test[5] and it was performed according to standard procedures without the use of hearing aids.

LogMAR chart

The vision testing tool included screening VA with a Bailey-Lovie LogMAR distance acuity chart (152), as shown in Figures 3 and 7. The LogMAR chart was chosen because it provides the most valid results, it is easy to understand, and use, and easy for nurses to transport on home visits. VA (LogMAR) values ranging from 0.0 to 1.0 (equivalent in meters to Snellen 6/6 to 6/60) were measured at a distance of 6 or 4 m depending upon the size of the room. When the distance was 4 m, the results were recalculated to express the equivalent values for 6 m. VA scores for the better eye were decimalized into VA > 0.8, 0.4 - 0.8 and < 0.4, which were characterized as normal, slightly visually impaired, and visually impaired, respectively (2, 153). The cutoff and gold standard was set to be VA = 0.7. The test was conducted according to standard procedure, which is with best correction (i.e. with the subject wearing his/hers usual spectacles) and in the presence of habitual lighting conditions. The LogMAR chart is a standardized instrument[6].

Hagner ScreenMaster luxmeter

A light-measuring device (Hagner ScreenMaster, Solna, Sweden) was used to measure the light levels (as lux values) in the patients' homes. The living room was divided into $1 \times 1\text{-m}^2$ squares, and light levels were measured at 80 cm above the floor level in each square (18). The minimum and maximum light levels in the living room were measured and the mean lux value was calculated, as was that for the reading light if the room had one. There are various

[5] It is a standardized instrument but not an entirely objective measurement, since it relies on a certain level of participation by the subject being measured. The results are interpreted by the person conducting the test.
[6] It is a standardized instrument, but not an entirely objective measurement since it is dependent on the participant's participation. The results are interpreted by another person.

light-level recommendations for certain environments, such as 500–700 lux being recommended in a ward office. Different recommendations for elderly and visually impaired people have been suggested, but there does not seem to be any international consensus on minimum lux values. A Norwegian guideline recommends the following values for older people: hall and corridor, 300–500 lux; living room (general lighting), 200 lux; dining table, 500 lux; and reading light, 750–1000 lux (3). An American guideline recommends 300 lux as the lowest limit for ambient light in living areas (including the living room) for older people, and 750 lux for task lighting (79).

KAS-Screen

The KAS-Screen (14) was used for screening hearing and vision impairments, and their impact on daily life (Appendix IV). This instrument consists of 110 open and standardized questions designed to reveal the participants' assessments of their sensory impairments. The KAS-Screen yields information on the following nine subscales: (i) background, (ii) vision and hearing, (iii) verbal communication and social life, (iv) access to information, (v) orientation and mobility and (vi) ADL/IADL, (vii) health issues and the need for help, (viii) social network and where the patient lives and (ix) financial situation and special circumstances. The questions used in this study were taken from the first six subscales. Questions about the use of a white stick or "a hand alphabet" were not included in the study, since none of the participants used them. The KAS-Screen contains the global question "Do you consider your hearing/vision to be good, not so good, poor or very poor/deaf/blind?" and the more detailed questions about communication and reading abilities used in this study. A previous evaluation and validation found the KAS-Screen to be adequate for detecting hearing and vision impairments in the elderly (14, 16).

Nurse logbooks

The nurses, who screened and performed the intervention in the IG, were given a logbook at T_1. In this logbook they could write down reflections, comments and observations during the 10-weeks the intervention period. These logbooks were collected by the end of T_2, and they were intended to be a source of supplementary information for the study.

4.4.2 Intervention

Substudy 2 consisted of two main elements: (1) screening every patient for their functional hearing and vision, and the lighting conditions in their home, and (2) the intervention lasting 10 weeks, including advice and self-care support depending on what the nurses found in the screening at T_1. The nurses advised the elderly in the IG to make relevant changes, and supported their self-care ability in relation to hearing, vision and indoor lighting conditions.

To ensure that the intervention was standardized and reproducible, the nurses were provided a set of standard procedures for how to advise and support the elderly. The patients in the IG received advice on improvements to their home lighting conditions after T_1. If the lux values were below those recommended, or if lighting factors that negatively affected the daily functioning, reading or communication abilities of the IG participants were identified, they were advised on how to improve the lighting conditions in their home (Appendix II).

The intervention was tailor-made in the sense that IG participants were given individual advice, and they were advised to perform the self-care activities in a step-by-step manner that involved attending to the simple things first. They were advised to have their ears rinsed for earwax if needed. If the hearing test revealed a PTAV value at T_1 of ≥ 35 dB, or if the vision test yielded a VA of ≤ 0.7, the IG patients were referred to a specialist (Appendix III).

The methods used to improve functional hearing and vision were the use of hearing aids, removal of earwax, custom-made spectacles, and increased lighting levels.

Since the study was performed during the dark winter months in order to facilitate the detection of any effects of the lighting conditions, a 10-week period was considered adequate (154). The nurses were instructed to ask the patients whether they needed help to book an appointment with a specialist or their GP, or if there were other issues or proposed improvements related to the study for which they needed help. However, this help did not include transportation to receive specialist care. The nurses were also not present when the patient visited a specialist or their GP, but they would be able to help them to arrange the visit.

The nurses provided information to the IG patients regarding how to increase the lighting levels or improve the lighting conditions in some other way in their living room. This could be achieved by adding more lamps, changing to brighter light bulbs, moving lamps in order to achieve a softer lighting and improve the direction of the light for reading, or providing information on how to avoid distracting shadows or glare from windows, spotlights, or chandeliers. They were also offered help to install a lighting control system that would allow them to operate all of the lamps in one room with a single switch. They received information about where to buy an inexpensive lighting control system. The help did not include any financial support, but the advice given did focus on inexpensive interventions. If the elderly were advised by the optician to buy new custom-made spectacles, this could become a larger expense. An underlying assumption of the intervention was that the elderly can be motivated to optimize their functional hearing and vision if they are aware of their state and are presented with methods for improving it. It was assumed that they would take the necessary steps to implement the measures suggested to them. The theory of self-care presupposes that

people have the knowledge necessary to perform the self-care activities, and this was operationalized by attempting to make this knowledge accessible to the IG participants.

The patients in the CG were screened and evaluated in the same manner as the IG patients at both T_1 and T_2. However, they were not referred to specialists even if their hearing or vision was considered to be impaired. Furthermore, they were not advised about how to improve their home lighting conditions even where these were found to be inadequate, until after the completion of the study. During the period of the intervention, the CG participants received their usual home-care services. In order not to contaminate the patients in the CG, they were as mentioned above, screened by the two nursing assistants specially trained in hearing and vision as well as by the present author, and not by the same nurses as in the IG.

4.5 Data collection

Data collected for Substudy 1 were collected at T_1 by the ten nurses, the two nursing assistants specially trained in hearing and vision, and by the present author. Since the entire sample was divided into two groups (IG and CG) from the start of the recruitment, the 50 participants who later constituted the IG in Substudy 2 were screened by the 10 nurses, and the 50 participants who later constituted the CG in Substudy 2 were screened by the 2 nursing assistants and the present author.

For Substudy 2, the ten nurses collected the data from the IG, and the two nursing assistants and the present author collected the data for the CG.

The intervention period for Substudy 2, performed by the ten nurses, started immediately after the first screening had ended. The second screening at T_2 for Substudy 2, started after the end of the 10 weeks and was finished by the end of February 2012.

A lighting designer measured the lighting conditions in the homes of 20 of the patients in the CG, and checked most of the lux values in both groups, to ensure that they were measured correctly.

Since it was the functional hearing that was being measured, there were some challenges evaluating this if the person being screened used hearing aids. Unlike the assessment of corrected vision with spectacles, we did not have the technical means to measure and evaluate corrected hearing with hearing aids in a simple manner at home using a standardized instrument. However, the hearing measurements made using standardized instrument were improved hearing after earwax had been removed. In addition, we asked the elderly person to self-assess his/her functional hearing using a single global question, and we asked about communication ability in more detail. The functional vision was measured at T_2 using improved or custom-made spectacles if they had these, or under better lighting conditions in the home. We further measured the functional vision by asking the person to self-assess his/her vision using a single global question, and by asking him/her about reading ability in more detail. We checked whether the lighting in the home were improved at T_2, but this was secondary outcome.

We wanted to examine one primary outcome of the intervention, which was the functional hearing and vision. This was measured in two different ways: (1) by the standardized instruments (PTA and LogMAR), and (2) by using self-assessment (KAS-Screen), with a single global question, and several questions regarding functional hearing and vision.

4.6 Data analysis

Statistical analysis for both substudies was performed with the Statistical Package for Social Sciences for Windows (SPSS versions 20 and 21.0; IBM, USA). The cutoff for statistical significance was set at $P \leq 0.05$.

4.6.1 Statistical analysis for Substudy 1

Descriptive statistics were used to examine demographic data, functional hearing at different frequencies, functional vision, and indoor lighting conditions.

The distribution of the answers obtained by applying the KAS-Screen indicated that it would be appropriate to recode the four response alternatives into two, in order to increase the number of patients in each group and to ensure appropriate group sizes for further analyses (154). This recoding was done after the data were collected. The original response alternatives of "yes, that's fine" and "it is sometimes difficult" were recoded into "yes, usually" while "it is very difficult" and "no, I cannot do it" were recoded into "no, not usually".

Linear regression analysis was used to examine the relationships between the sensory impairments, sex, and age. One-way ANOVA was used to examine the relationships between the results of standardized tests and the self-assessments. Bivariate correlations, χ^2 tested cross-tabulations, and Spearman's ρ were used to determine whether impaired hearing and vision rendered it more difficult to communicate, read, and perform daily activities, including ADL and IADL. Dual sensory impairment was defined as impairments in both hearing and vision (16). Odds ratio was calculated for dual sensory impairment.

4.6.2 ROC curve analysis for Substudy 1

Receiver operating characteristic (ROC) curve analysis was used to compare self-assessments of functional hearing and vision with a gold standard test. An ROC curve is a graphical plot that illustrates the performance of a binary classifier system as its discrimination threshold is varied, while other events (called "noise") are ignored or rejected (155). With two alternative events, such as "yes, having a sensory problem" and "no, not having a sensory problem," the primary data are those of a two-by-two contingency table. The event is considered to be either "positive" or "negative": where having the signal event (impairment) is considered to be positive. There are two ways in which the actual event and the impairment can agree (i.e., two kinds of correct outcomes), called "true positives" and "true negatives," and two ways in which the self-assessment and the standardized measurement can disagree (two kinds of errors), called "false positives" and "false negatives" (156). The curve on the graph shows the relationship between the proportions of true positives and false positives that is characteristic of the particular measurement under investigation (156). The area under the ROC curve (AUC) quantifies the discriminatory ability of the test. The test result is considered excellent, good, fair, poor, or failed if AUC is >90%, 80–90%, 70–80%, 60–70%, or 50–60%, respectively (157).

For the self-assessment tests, the patients were asked to self-assess their hearing and vision on a 4-point Likert scale, where 0 was "good", 1 "not so good", 2 "poor" and 3 was "very poor/deaf/blind". Gold standards for the PTAV and the VA tests were set in accordance with the limit for referrals and according to the WHO standard (1, 2). The following reference values were applied for hearing: No impairment or very slight impairment PTAV $\leq$ 25 dB, slight impairment (hearing aid may be needed) PTAV = 26-40 dB, moderate impairment (hearing aid usually recommended) PTAV = 41-60 dB; severe impairment (hearing aid or lip reading needed): PTAV = 61-80 dB; and profound impairment (unable to hear): PTAV > 81

dB. The cutoff and gold standard was set to be PTAV = 35 dB. The following reference values were applied for vision: normal vision, VA $\geq$ 0.8; slight visual impairment, VA = 0.4-0.8; and visual impairment, VA $\leq$ 0.4. The cutoff and gold standard was set to VA = 0.7. The results were dichotomized into two binary scales: (i) PTAV $\leq$ 35 dB was defined as no hearing problem, and PTAV > 35 dB was defined as a hearing problem and (ii) VA > 0.7 was considered to indicate no eyesight problem and VA $\leq$ 0.7 was considered to indicate an eyesight problem.

4.6.3 Statistical analysis for Substudy 2

Descriptive statistics were used to examine the frequencies for light levels, PTAV measurements and VA measurements, as well as for data from the KAS-Screen. An independent-samples *t*-test, paired-samples statistics, and one-way ANOVA were used to calculate the relationships between groups and variations within groups. Linear regression analysis, logistic regression, and χ^2-tests across tabulations were used to examine the relationship between variables. Cutoff for statistical significance was set at at $P \leq 0.05$.

4.7 Ethical considerations

The study participants were sent an information leaflet that described the purpose, goals and methodology of the study; this information was also provided orally. Confidential information was kept securely locked in cabinets, and the research data were kept on the secure research-server at the University College.

Participation in the study was voluntary, and all of the participants signed a written consent stating that they were participating voluntarily after they had received oral and written

information about the study. The participants were also informed that they could at any time withdraw their consent without giving a reason, and information relating to them would be removed after the study was completed.

For Substudy 2, the proposed changes in the home could have financial and/or esthetical consequences. The nurses therefore collaborated closely with the participants, and if possible also with their immediate relatives when and if changes were proposed. However, the nurses were also instructed to encourage the participants to make the proposed changes wherever possible, so that the effect of the intervention could be investigated. In addition, the nurses were reminded to exhibit discretion, and that their understanding of the participants' situation could be critical to assessing the existing opportunities and what was appropriate to propose. The nurses were asked to record such actions in the logbook during the intervention period. These issues were discussed during the training program.

The patients in the CG were informed by the home-care services of their results after the second screening at T_2, and they were also offered advice and help (if they wanted this) after the intervention had ended.

The study was considered by the Regional Ethics Committee, reference number 2011/1408 and approved by the Norwegian Social Science Data Services, project number 28025.

5 MAIN RESULTS

The main results for each substudy are presented separately in Sections 5.1 and 5.2.

5.1 Substudy 1

This section presents the results from Substudy 1. Of the 100 home-care participants who were recruited, 93 completed Substudy 1.

5.1.1 Sample and sociodemographic data

The mean age of the 93 participants in the study (72 women and 21 men) was 88, 8 years. The highest level of education was 7 years of elementary school for 68 % (n = 63) of the participants, continuation school (or lower secondary school) for 10 % (n = 9), secondary school for 11 % (n = 10) and high school or university for 12 % (n = 11).

All of the participants had serious health challenges and needed assistance to manage their daily lives. They rarely left their home and 62% never did so alone, while 73% could not use public transport because of health issues and 26% needed to be escorted or helped when taking a taxi.

5.1.2 Functional hearing

Half (n = 46) of the participants reported that their hearing was good in the self-assessments of hearing, but the results from the PTAV measurements showed that only 7 of these 46 participants in fact had no or only very slight hearing impairment. The distribution of the PTAV is presented in Table 4.

Table 4 Distribution of the measured PTAV values

Degree of hearing impairment according to WHO reference values			%	(*n*)
No impairment or very slight impairment	PTAV	≤25 dB	7.5	(7)
Slight impairment (hearing aid may be needed)	PTAV	26–40 dB	40.9	(38)
Moderate impairment (hearing aid usually recommended)	PTAV	41–60 dB	47.3	(44)
Severe impairment (hearing aid or lip reading needed)	PTAV	61–80 dB	2.2	(2)
Profound impairment (unable to hear)	PTAV	≥81 dB	2.2	(2)
Total			100.0	(93)

5.1.3 Functional vision

Most (54 %) of the participants reported that their vision was good in the self-assessments of vision, but the results from the VA measurements showed that only 4 of these 50 participants in fact had normal vision (with best correction and in their habitual lighting conditions). The distribution of the VA values is presented in Table 5.

Table 5 Distribution of the measured VA values

Degree of vision impairment according to WHO reference values			%	(*n*)
Normal vision	VA	>0.8	4.5	(4)
Slightly visual impairment	VA	0.4–0.8	55.7	(49)
Visual impairment	VA	<0.4	39.8	(35)
Total			100.0	(88)

5.1.4 Communication and reading abilities

Table 6 indicates that communication, access to information and reading were considered to be especially important for those aged 80+ years. More than 75 % (*n* = 70) of the participants had no difficulties performing ADL/IADL because of hearing or vision impairments; however 17% (*n* = 16) did report difficulties. In terms of verbal communication, 27 % (*n* = 25) said they needed to look at the face of the person they were talking to, 62 % found it difficult to understand dialects and 59 % (*n* = 55) experienced difficulties understanding when people

talked too rapidly, too quietly or unclearly. Most of them (94 %) could read news headlines and 79 % (n = 74) could read regular newsprint, but 41% (n = 38) could not read very small print and nearly one-third 29 % (n =27) of the participants found it tiresome to read.

Table 6 Self-assessments of abilities to communicate and read (from the KAS-Screen)

Variable (questions from the KAS-Screen)	No, not usually*	Yes, usually*	Missing data (n)
Difficulties performing ADL/IADL because of vision or hearing impairment	75.3 (70)	17.3 (16)	7
People talk too rapidly, too quietly, or unclearly	41.0 (38)	59.0 (55)	0
Difficult to understand when many people are talking	26.9 (25)	72.1 (67)	1
Difficult to understand dialects	37.7 (35)	62.4 (58)	0
Need to look at the face of the person who is talking	73.2 (68)	26.9 (25)	0
Hearing is impaired during conversations	84.9 (79)	15.1 (14)	0
Difficult to speak on the telephone	75.3 (70)	24.8 (23)	0
Difficult to speak to strangers with unfamiliar accents	65.6 (61)	34.5 (32)	0
Can read newspaper headlines	6.4 (6)	93.5 (87)	0
Can read regular newspaper print	20.4 (19)	79.2 (74)	0
Can read very small newspaper print	40.9 (38)	59.1 (55)	0
Find it tiring to read**	67.7 (63)	29.0 (27)	3
Can see text and pictures on TV and can hear TV	10.0 (9)	90.0 (83)	2
Difficult to recognize people because of vision impairment	70.9 (66)	29.1 (27)	0
Can hear the radio/TV/music player	13.0 (12)	85.0 (79)	2
Can hear the doorbell	95.7 (89)	2.2 (2)	2
Can hear a fire alarm and other types of alarm	68.8 (64)	30.1 (28)	1
Can see/hear what time it is	98.9 (92)	1.1 (1)	0
Often bump into objects or stumble	75.3 (70)	24.8 (23)	0
Vision impairment is an obstacle to moving indoors in familiar places	92.5 (86)	7.6 (7)	0

***Data are % (n) values. **NB: reversed scoring ("no not usually" here means no problem)**

5.1.5 ROC curve analysis of functional hearing

An ROC curve analysis and a cross tabulation of the self-assessed functional hearing and PTAV measurements (see Figure 8 and Table 7, respectively) revealed that the AUC was 73 %, meaning that all of the 18 participants who stated that their hearing was good, were actually false negatives. According to the gold standard, they fell in the group of people who were only able to hear moderately loud sounds (a hearing impairment of $\geq$ 35 dB) and so should be referred to an ear specialist to have their hearing checked, and if possible, corrected.

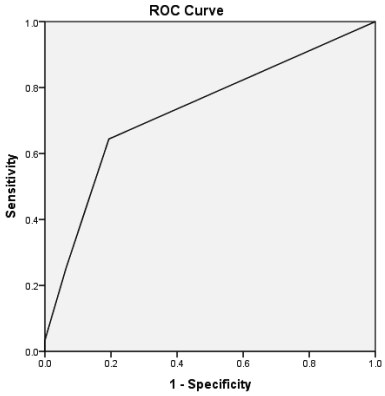

Figure 8 ROC curve showing the relationship between PTAV and patient self-assessments of hearing

Table 7 Cross-tabulation of self-assessments of hearing and PTAV

Self-assessment of hearing	PTAV ≥35 dB Hearing problem (*n*)	PTAV <35 dB No hearing problem (*n*)	Total
0 = good	18	0	18
1 = not so good	21	3	24
2 = poor	24	2	26
3 = very poor/deaf	4	1	5
Total	67	6	73

5.1.6 ROC curve analysis of functional vision

An ROC curve analysis and a cross-tabulation of the self-assessed functional vision and VA measurements (see Figure 9 and Table 8, respectively) revealed that the AUC was 69%, meaning that 40 of the 49 of participants who had taken both tests and stated that their vision was good were actually false negatives, indicating that the self-assessment test was unreliable.

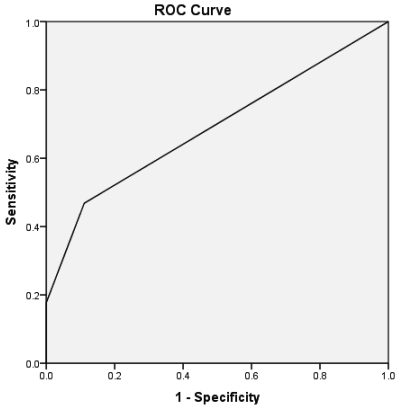

Figure 9 ROC curve showing the relationship between VA and patient self-assessments of vision

Table 8 Cross-tabulation of self-assessments of vision and VA

Self-assessment of vision	VA >0.7 No eyesight problem (*n*)	VA ≤0.7 Eyesight problem (*n*)
0 = good	9	40
1 = not so good	1	21
2 = poor	0	5
3 = very poor/blind	0	5

5.1.7 Summary of the results from Substudy 1

Many of the elderly home-care patients in this study were living with serious hearing and vision impairments, and reduced reading and communication abilities. The ROC curve analysis demonstrated that they self-reported that their functional hearing and vision were better than the results from the standardized tests.

5.2 Substudy 2

This section presents the results from Substudy 2, in which the IG were advised and counseled about how to improve the functioning of hearing and vision, while the elderly in the ADL, while the elderly in the CG were not given such advice and counseling. The primary outcome of the intervention was measured using both the standardized tests (PTA and LogMAR) and participants' self-assessments.

5.2.1 Sample

The sample and sociodemographic data for the two groups are presented in Table 9.

Table 9 Sociodemographic data for the two groups in Substudy 2

	T_1	
	IG	CG
Age, years (mean)	88	88
	% (*n*)	% (*n*)
Living arrangement		
Alone	71.7 (33)	70.2 (33)
With another person	17.4 (8)	27.7 (13)
In the same home, but separately	10.9 (5)	2.3 (1)
Type of home		
Total	100 (46)	100 (47)
Detached	41.3 (19)	40.4 (19)
Semidetached	8.7 (4)	21.3 (10)
Apartment	26.0 (12)	17.0 (8)
Sheltered housing	24.0 (11)	17.0 (8)
Total	100 (46)	100 (47)

Education		
Elementary school	71.7 (33)	63.8 (30)
Continuation school	8.7 (4)	10.6 (5)
Secondary school	13.0 (6)	8.5 (4)
High school	6.5 (3)	17.0 (8)
Total	100 (46)	100 (47)
Family		
Children	93.5 (43)	85.1 (40)
Financial status		
Comfortable	8.7 (4)	6.4 (3)
Adequate	58.7 (27)	63.8 (30)
Difficult	26.1 (12)	29.8 (14)
Total	93.5 (43)	100 (47)
Psychosocial		
Have concerns about life	45.7 (21)	51.1 (24)
Feel safe when at home	95.7 (44)	100.0 (47)
Have visitors every week	52.2 (32)	53.2 (31)

5.2.2 Functional hearing and vision – measured by standardized tests

The results of the PTAV-measurements of the intervention indicated that there were no significant changes in either the IG or CG between T_1 and T_2. One way ANOVA revealed that there was also no significant difference between the groups ($P = 0.10$). A paired-samples *t*-test showed that self-assessed functional hearing had changed significantly at T_2 in the IG, but not in the CG.

The results from the LogMAR tests and VA-measurements of the intervention revealed some very slight improvements in the VA in both groups between T_1 and T_2, but the improvements

did not differ between the groups ($P = 0.57$, one-way ANOVA) and they were also below the threshold for clinical significance. An independent-samples *t*-test revealed that the change differed significantly between the groups ($P = 0.026$), being larger in the CG. A paired-samples *t*-test revealed that mean VA was 0.49 at T_1 and 0.50 at T_2 in the IG ($P = 0.28$) and had changed from 0.40 to 0.43 in the CG ($P = 0.03$).

5.2.3 Findings for earwax

Examinations with the aid of a Heine Mini 3000 otoscope revealed that nine patients had earwax problems (five in the IG). The IG participants were advised to have earwax removed during the intervention period, and by T_2 all five had seen their GP and had their earwax removed.

5.2.4 Self-assessments of functional hearing and vision

The self-assessments of functional hearing and vision were analyzed using the nonparametric Wilcoxon rank-sum test. For the IG, the self-assessed function had improved significantly at T_2, with *P*-values of 0.008 and 0.025 for hearing and vision, respectively. This means that the IG participants assessed both their hearing and vision to be better by T_2 than at T_1.

5.2.5 Indoor lighting

The results obtained when measuring indoor light levels using a Hagner Screen Master luxmeter at T_1 and T_2 are presented in Table 10.

Table 10 Measured light levels (in lux) at T_1 and T_2

	IG		Mean change	CG		Mean change	*P*	Recommended Minimum light levels	
								Norway[1]	US[2]
	T_1	T_2		T_1	T_2			Minimum levels	
	n =34	*n* =34		*n* =36	*n* =36				
Mean	87	157	70	51	46	–5.3	0.009	200–300	300
Max	194	324	130	138	111	–26.6	0.002		
Min	31	66	35	18	18	–0.4	0.039		
Reading light	*n* =31 385	*n* =31 479	95	*n* =29 295	*n* =29 257	–37.9	0.200	750–1000	750

[1] Lyskultur 11/97, [2] Illuminating Engineering Society of North America 28/2007

The initial lux values in both groups were far below the recommended values at T_1, but the mean value had increased by 70 lux in the IG by T_2. However, in both groups at both times, the mean light levels were clearly below the recommended values of 200-300 lux.

5.2.6 Nurse logbooks

The documentation in the nurse logbooks varied somewhat between the ten nurses. Specific advice concerning their indoor lighting conditions was given to 30 of the 46 participants in the IG. This included advice about installing an inexpensive lighting control system, buying or adding more lamps, moving lamps or using more lamps that were already in the home, and changing to brighter light bulbs. If their homes had dark curtains or had plants on their windowsills, it was suggested that they could change to lighter curtains or remove the plants. None of the participants had bought any new lamps or installed a lighting control system at T_2, but many had installed brighter light bulbs in their lamps, and they switched on more of the lamps already in the home at T_2. None of them had changed their curtains, but three had removed objects or plants from the windowsills. Twenty-three of the IG participants were offered a referral to a hearing specialist and 38 were offered a referral to an optician or

ophthalmologist, while 27 of them were already receiving treatment for their vision impairment. Some of the participants in the IG did not want advice or to be referred to a hearing or vision specialist (Paper III). Half of those who were referred to a hearing specialist had booked an appointment or had seen the specialist at least once by T_2, but none of them had received a new hearing aid. Only 2 of the 11 IG participants who were referred to an optician or ophthalmologist had seen the specialist by T_2, and none of them had bought new spectacles.

The nurse logbooks also revealed that the elderly felt it was tiring and demanding to travel to a specialist by taxi or to book a special taxi that could take a wheel-chair (for those who had difficulty walking).

5.2.7 Summary of the results from Substudy 2

Several of the elderly in the IG did not follow all of the advice offered by the study nurses, but some of them did follow some of the advice and there were significant improvements in the self-assessed functional hearing and vision as well as improvements in the indoor lighting conditions at home. There are several possible reasons for the participants not following all of the advice, and it might indicate that very old home-care patients with serious health challenges cannot be expected to take all of the actions necessary themselves to improve their functional hearing and vision as well as their home lighting conditions. This population requires close assistance and help to see a specialist and to improve the indoor lighting conditions in their homes.

6 DISCUSSION

The aims of this thesis and the two substudies were to obtain knowledge about the characteristics of hearing and vision impairments in elderly recipients of home care, and to measure the effects on an intervention aimed at improving their functional hearing and vision, and the lighting conditions in the home. The discussion in this chapter is organized into sections according to the three papers stemming from this study. Section 6.1 deals with the characteristics of functional hearing and vision (Paper I), Section 6.2 addresses the relationship between standardized tests and self-assessments (Paper II), and Section 6.3 deals with the effects of the intervention (Paper III) and 6.3.1 deals with self-care activities as the means to achieve results from the intervention. Section 6.4 includes the discussion of strengths and limitations of the study, while Section 6.5 focuses on the possible implications for practice, and Section 6.6 presents a brief discussion on further research.

6.1 The characteristics of functional hearing and vision

Slight hearing impairment was found in 40.9% of the entire sample and moderate hearing impairment was found in 47.3%, which means that most of the participants had noticeable functional hearing impairments. Despite this, 50% of the participants self-assessed their own hearing as being good (Paper I). Figure 1 shows that slight and moderate hearing impairments are associated with difficulty in distinguishing especially the consonants in a word, but also between vowels, so this impairment can have an impact on the communication ability.

The same pattern was evident in the VA scores, which showed that 55.7% of the entire sample had slight visual impairment and 39.8% had visual impairment (Paper I). In contrast, the assessments of the participants themselves using the global question revealed that 54%

self-assessed their vision as being good (highest score). However, it is challenging to understand the WHO classification scale (2) classifying *normal vision* as a VA between 0.8 and 1.0 and *slight vision impairment* as a VA between 0.4 and 0.7, which is a large range. Norwegian authorities consider that the VA must be at least 0.5 before issuing a driving license (74), and so the inclusion of the word "slight" in the WHO classification may be misleading, especially given that a visual impairment is actually quite serious when the VA is 0.4.

The results from self-assessing the communication and reading abilities based on more detailed questions indicated that 72% of the participants found it difficult to understand speech when several other people were speaking simultaneously, which is in accordance with previous research (51), and 62% found it difficult to understand dialects or foreign accents (Paper I). It may have been necessary to have sentences rephrased or spelled out, because 27% also reported that they needed to look at the face of the person they were talking to (Paper I). Some of them would have to strain their eyes to read very small newspaper print, since 41% found it too difficult to read when the best correction was applied to their eyesight (Paper I). These results indicate that there are functional challenges in everyday life related to having "slight hearing impairment" and "slight vision impairment" according to the WHO definitions. It also highlights the importance of being aware of the lighting conditions, which is discussed further in Section 6.3.

The results from the KAS-Screen and the nurse logbooks revealed that 11% of the participants had a hearing aid, but only two-thirds of those people used them daily (Paper I). Otoscopy examinations revealed that the amount of earwax in around 10% of the entire sample would be sufficient to affect their hearing (Paper I). This is in accordance with previous research (12). There was no systematic examination of why many of the participants

who had a hearing aid in this study did not use it, but some of the nurses had documented in the logbooks that the hearing aids were not adjusted correctly or that the participants found it was too difficult or annoying to use them. Difficulty can be experienced when starting to use hearing aids (158), and the elderly might have needed more customization, help, and follow-up than they previously had received. There is also a question of whether it is necessary to wear hearing aids when one is alone and is not listening to anything, or if it is necessary to wear spectacles if one is not reading or looking at anything specific.

Most of the study participants did not have custom-made spectacles, instead using inexpensive ready-made spectacles, which do not take into account any of the refractive errors or other problems that commonly develop in the elderly (Paper I). Although we do not have definitive data to explain why only 6% of the participants wore their spectacles daily, and around 5% wore their spectacles only occasionally (Paper I), the use of ready-made rather than custom spectacles could be an explanation. In addition, both this study (Paper III) and other studies (3, 21) have found that many elderly live in poorly lit environments, which might influence both communication and reading abilities. This may also be related to 27% of the entire sample stating they needed to look at the face of the person they are talking to, 41% stating they could not read very small print, and 29% finding regular newspaper print tiring to read (Paper I).

Taking into account safety and security considerations, and the need for the elderly to learn how to use hearing aids, and get used to wearing both hearing aids and spectacles, it may be desirable for them to use the aids also when they are alone, even when not doing or reading anything specific. Moreover, impaired hearing could result in a person not hearing a fire alarm or when someone enters the home, and impaired vision may be associated with falls, accidents, or difficulties with reading very small print on medicine containers for example.

Adults in later life reportedly experience a lower sense of control compared with their younger counterparts (159-163), and according to Schieman et al (164), the education level, marital and financial status are related to the sense of control. The elderly in the present study were not asked about their sense of control, but 7 years of elementary school was the highest level of education for 68% of the participants, 71% lived alone, and 26% reported that they had to be especially careful with their finances (Papers I and III). These characteristics may indicate that the participants experienced a lower sense of control (160, 164). An important point to consider is that there may be a general lack of adequate information on how to preserve and improve functional hearing and vision in old age (158).

6.2 The discrepancy between patient self-assessments and results from using standardized instruments

Another important finding in Substudy 1 was a discrepancy between the patient self-assessments, when they answered the global question about hearing and vision impairment and the results obtained using standardized tests (Papers I and II). The gold standard and limit for referral to a specialist was PTAV $\geq$ 35 dB, indicating that all of the participants who stated their hearing as good actually failed the test (i.e., they were false negatives) (Paper II). Gibson et al (165) compared the results from a whispered-voice test with patients' self-assessments of hearing using a global question, and found fewer false negatives (8 out of 150). However, it is important to remember that a whispered voice test is only appropriate for determining hearing impairments within the range of 30-40 dB, and thus has some limitations relative to a standardized audiometric test.

The gold standard and limitation for referral to a specialist for visual impairment was VA $\leq$ 0.7, indicating that most of the participants who stated their vision to be good actually failed

the test (i.e., they were false negatives) (Paper II). This means that a reliable answer cannot be expected when asking the global question.

Hearing and vision impairments are associated with a loss of body functionality and normal physical decline with age. Despite the impact on daily living (40, 166-169), older people might tend to consider this condition to be a normal aspect of aging and therefore not seek help, instead coping with the impairments by reducing their personal expectations about their everyday lives (170, 171). Age-related sensory impairments develop very gradually, and the elderly often adapt without being aware of how these impact on their daily living (172). This is consistent with Eilertsen et al (21) finding that healthy home-dwelling 75-year-olds had changed their daily routines and, possibly without even noticing it themselves, had moved activities from the evening to the daytime when lighting conditions were better. However, some of the elderly in the present study owned hearing aids and/or spectacles, indicating that they had taken steps to compensate for their impairments and had attempted to optimize the functioning of their hearing and/or vision. We do not have definitive data for explaining why they did not use their aids regularly on a daily basis, but they may have felt that the previous help they had received was inadequate as some of them who had hearing aids and spectacles in the home did not use them.

It is common in Norway and some other countries to simply ask elderly patients in the home care setting about their functional hearing and vision (Appendix 1) (52, 75, 77). Usually no further examinations are carried out when patients report that their hearing and vision are functioning well.

It is of interest to determine whether the results from self-assessments are more reliable when asking more detailed questions about communication and reading abilities, relative to asking a single global question. The answers obtained in the present study when using the more

detailed questions seem to be more in line with the results obtained using the standardized tests (Paper I). This could be due to it being easier to assess a more specific question than a very general one. Although the questionnaire used in the study had been validated, the phrasing of the questions is still important. When we ask someone "how are you doing?" the person might answer "very well" or "good" even where he or she is suffering from a disease. Thus, we do not actually know whether they say that their hearing and/or vision is just "good enough" in spite of their age and health condition, meaning that they have taken this into account. We must also consider differences between global self-assessment questions. Another global question could be: "Do you have a hearing problem now or how do you rate your hearing on a scale from excellent, very good, good, fair, or poor?"(76, 77). Gibson et al (165) asked the question: "Is your hearing with or without a hearing appliance excellent, very good, good, fair, or poor?" and they had additional questions like: "Can you follow a conversation with one person?", "Can you follow a conversation with four people?" and "Can you use a normal phone?"

6.3 Effects of the intervention

The results from the baseline screening demonstrate that the elderly in this study lived in badly lit environments, which is also consistent with previous studies (21, 23, 149). The findings in Substudy 2, showing that the elderly in the IG had taken important steps to improve their indoor lighting conditions may indicate that the elderly would improve their indoor lighting conditions when they are able to.

The results from the intervention measured at T_2 showed that the lux values in the homes of the IG participants were significantly higher by the second screening, but still clearly below the recommended values (Paper III). The participants had not bought any new lamps, or a

simple inexpensive lighting control system, that would allow the lamps to be operated using a single switch. If they had, it might have been easier to reach the recommended lux values. The presence of appropriate lighting conditions in the home is considered important for both daily functioning and safety reasons. We did not examine why the elderly in this study did not purchase any new lamps or an inexpensive lighting control system, but it might indicate that some of them found it too expensive or practically difficult to buy new lamps and/or a lighting control system. It is also possible that they simply did not want to change the aesthetics of the home environment. There is literature indicating that the home is an expression of oneself (114, 173-175). The lighting in a room can alter the sense of decoration, and many elderly might like to decorate and present their home in a certain way (108). It is also important to accept that the home is the owner's territory, and some elderly might prefer to mark their territory in a their own way that is incompatible with optimal lighting conditions (108).

Since too much earwax was considered to affect the functional hearing of five of the IG participants, after they were advised to have this removed, all five of them had seen their GP during the intervention period exactly for this purpose. Moreover, half of those who had been referred to a hearing specialist had indeed booked an appointment, and some of them had also seen the specialist at least once. We do not know how many of the participants needed a new hearing aid, but none of them had received a new hearing aid by T_2, which perhaps is understandable given the time that it can take to obtain a new hearing aid, and they need for a specialist to be involved.

All 38 participants in the IG were assessed as having vision impairment, but 27 of them were already receiving treatment for serious visual diseases and thus 11 IG participants had been referred to a vision specialist during the intervention. However, only 2 of them had actually

visited the specialist by T_2. We do not have data on whether they ordered new custom-made spectacles, but none of them had received this by the end of the intervention period (Paper III).

In Paper II we argue, based on an ROC analysis of global self-assessment and tests with standardized instruments that it is not advisable to draw conclusions about functional hearing and vision solely on self-assessments. It may therefore seem inconsistent to have used self-assessments of hearing and vision as outcome measures in Paper III. However, there are several reasons for employing such self-assessments. First, decisions about using self-assessments were taken prior to conducting the analysis presented in Paper II. The results presented in Paper II were due to apparent inconsistencies in the data that we discovered when analyzing the baseline data in substudy 1, at which time we had already started the intervention in substudy 2. Second, although we argue that self-assessments of hearing and vision cannot stand alone, we maintain that they nevertheless reveal important information about how the patients themselves perceive that impairments in their hearing and vision impact on their everyday lives. We therefore believe that self-assessments and standardized measured hearing and vision should be combined.

In this study, self-assessments of hearing and vision were tested using the nonparametric Wilcoxon rank-sum test and the results showed that both functional hearing and vision were significantly improved for the IG patients at T_2 ($P = 0.008$ and $P = 0.025$, respectively; Paper III). Obviously, the intervention had not improved the hearing and vision of the participants at a physiological level. However, we believe that their functional hearing and vision improved in the sense that they *experienced* improved hearing and vision in their daily life. This could be due to better lighting, which was significantly improved for the IG participants, or other compensatory measures, such as removal of earwax or the use of better spectacles.

6.3.1 Self-care activities as the means to achieve results from the intervention

The results from the intervention suggest that the elderly might take more time and/or require more help when booking an appointment to see a specialist. The study was performed during winter, which meant that it was dark, cold, and icy/slippery outside. Most of the participants lived in rural communities. One of these communities, was a town of about 20, 000 inhabitants, while the remaining four communities were much smaller. A visit to a specialist could thus involve a taxi ride of up to an hour for most of the participants, which would be quite a long journey for elderly people who are in poor health. Such visits often also involve a lot of waiting, and so most of the day could possibly be spent on the visit. It would to be easier for most elderly to visit their GP, located in the local municipality, for the removal of earwax than visiting a hearing or vision specialist. Bearing in mind that the mean age of the participants was close to 90 years of age, and that they needed home-care services, the 10-week intervention period might have been too short to achieve all of the desired outcomes. Moreover, since the indoor lighting conditions were being measured, this had to be done during the relatively dark winter months, although this might not have been ideal in terms of the older participants going outside their homes for shopping and visiting specialists.

As already mentioned, a retrospective assessment of the results of the intervention revealed that the participants only partly followed the advice they were given about performing self-care (Paper III). This finding might in part be related to financial factors to consider. New custom-made spectacles and new lamps cost money in addition to taxi expenses, and would involve additional efforts. The participants had managed their lives despite their impairments up to the time of the study. In addition, they may have considered the possible future benefits to be uncertain relative to the economic cost and effort that would be required. None of these

considerations were expressed by any of the participants according to the nurse logbooks, but the participants were not explicitly asked about this.

The ability to perform self-care is considered to be a prerequisite for actually performing self-care activity (95), and such ability decreases with advanced age (176, 177). Söderhamn (176) found that the self-care ability is influenced by three reinforcing factors: self-care agency, being active, and feeling satisfied. The self-care ability is also influenced by four risk factors: receiving help, age, perceived helplessness, and close contact with other people. The reinforcing factors were all considered to be facilitating factors for self-care, and self-care ability and being active were of self-care agency (176). None of the elderly in this study were able to be active since they all had serious impairments. However, Söderhamn suggested that providing elderly people excessive help could produce negative overall outcomes, and the help required needs to be accurately assessed on an individual basis (176).

The self-care ability has also been found to be goal-directed, involving motivation (95, 176). Central to this motivation is according to Söderhamn (176) “the act of willing”, that is a purely inner act that precedes the voluntary action, and may form the beginning of such an action. In performing the act of willing, the ego proposes to itself to do something or not to do something, and this is a practical act of proposing filled with a certain intent of the will to do something (176). The participants in the present study may have doubted that it would be possible to optimize their hearing and vision, since several of them already had hearing aids and spectacles that might not have worked as they expected.

In a middle-range self-care theory, Riegel et al (99) focused on self-monitoring of one’s own health. Although that study mainly related to people with a chronic disease, self-monitoring is also be applicable to age-related sensory impairments. Ideally, people should be encouraged to start self-monitoring their hearing and vision once they reach the age of 50-60 years old,

and obtain information necessary to start detecting the typical age-related changes in the senses. If people have knowledge about the normal age development of their senses at an earlier age, they can start the self-monitoring process and establish regular contact with specialists, detect eye diseases sooner, and receive assistance to improve their functional hearing and vision at an earlier age. A survey of 75 year-olds living in Drammen in 2009 showed that they had not yet prioritized attending to their impairments even at that advanced age (149), suggesting that the elderly need to be encouraged to perform self-monitoring as early as possible.

According to Riegel et al (99), not only the symptoms but also the treatments and resulting changes should be monitored. The authors emphasized that self-care is an ongoing process. The same holds for sensory impairments given that monitoring age-related sensory impairments is a process that runs over time. Coping with age-related sensory impairments as well as chronic diseases is highly relevant for the elderly, because impairments may cause many limitations in physical, mental, and social functioning, which in turn may result in dependency on others (178).

Many factors influence whether a person is capable of taking the responsibility to perform self-care, such as age, financial status, physical condition, and the level of knowledge about health and disease. All of these factors play a crucial role as a precondition for being able to perform self-care (177).

While it may seem easy and relatively inexpensive to provide the type of advice given to the elderly in this study, they might actually need more help than what was offered in the present study, both practically and financially, to carry out the recommendations. Custom-made spectacles are much more expensive than ready-made ones, and therefore might not be prioritized by the elderly themselves. When there is a gap between the patient's capability to

perform self-care and the demands for self-care, as suggested by the findings described in Paper III, the nurse should, according to Orem et al (95), assist the patient and his/her relatives to fill this gap, using a partially or a fully compensating nursing system, based on an overall assessment. In most cases a partially compensating system would be sufficient for helping the patient. Based on the findings of Söderhamn (176) it is important to not exacerbate the perception of helplessness among the elderly, instead providing just the right amount of help that the individual person needs to perform self-care.

The present study has shown that it might not be realistic to expect the recipients of home care who are nearly 90 years old to perform the kind of self-care activities anticipated here merely by providing them with advice, information, and encouragement. Rather, they might need more help, support, and care, possibly also including financial help in some cases.

6.4 Strengths and limitations

The power calculation performed prior to the study indicated that a total sample of 100 participants (i.e., 50 in each group), would be sufficient to detect a difference in light level of 20 lux. We expected the rate of participant withdrawal in this study to be low due to the intervention being carried out by their regular contact nurses who were already known to the participants before the study started. However, four of the participants died and three were admitted to hospital during the data-collection period, so we ended up with a complete data set of 93 participants in Substudy 1. There were further dropouts during Substudy 2, and from 46 in the IG at T_1 to 41 at T_2, and from 47 in the CG at T_1 to 39 at T_2. But despite the fact that we did not quite achieve the number of participants we intended, we were still able to detect a significant difference in lighting conditions in the IG.

The inclusion criterion for age was ≥80 years, and the mean age of the sample was 88.8 years. This meant that the participants were generally old and fragile, and needed more help and supervision than was envisaged while the study was being designed.

There were some restrictions with respect to the recruitment procedure and randomization process in the home care setting. To ensure practicality of the study, we had to recruit participants from the districts where the study nurses worked, which resulted in there being districts in each municipality that were not included in the study. Therefore, the participants in this study are not necessarily representative of the whole population of elderly aged at least 80 years in the participating municipalities. This limits the ability to generalize the results obtained in this study. The five participating municipalities were located in the central southeast of Norway with a maximum 1-hour drive to a specialist. Many places and municipalities in Norway are more isolated and so further away from hospitals, specialists and opticians. In the north of Norway, above the Arctic Circle, it is also darker for a longer period during the winter months than it is in the area where this study was performed. Therefore, the hearing, vision, and indoor lighting conditions could be even worse in some other parts of the country.

The nurses were trained to advise and assist the patients in the IG every week for 10 weeks by asking the patients if they needed any help to book an appointment with a specialist or if they had other questions or problems related to improving the lighting conditions and/or implement measures to improve their functional hearing and/or vision. The nurses, who carried out the intervention as part of their ordinary home-care visits, did not have the time available to assist the participants in the IG to buy lamps (or do it for the patients) or drive them to specialists. But they could help the patient to install inexpensive lighting control systems. Some nurses may also have been more motivated than others, and thus perhaps made

more of an effort to persuade their patients to follow their advice. We cannot precisely quantify the effort made by the nurses during the 10-week study period. The nurse logbooks contained useful information about their observations and reflections, but they are not a completely reliable source due to the variable amounts written in these logs.

The participants in the IG had improved the lighting in their living rooms by increasing the use of lamps they already had, and by changing to bulbs giving higher lux values (Paper III). This study documented that it is easy to improve the lighting conditions in the homes of the elderly. Thus, even in cases where we could not demonstrate significant improvements in functional hearing and vision measured with standardized tests after the intervention, the study revealed that simple and easy-to-implement measures could have positive impacts on both the lighting conditions and the satisfaction of the participants as revealed in their self-assessments.

This intervention was performed in the context of the home, an environment that the participants would be familiar with and feel safe in, but it is unclear whether the intervention was sufficiently well adapted to the study sample. Evidence that the intervention was reasonable comes from those who increased their home-lighting levels and those who had seen their GP for the removal of earwax, but we had perhaps underestimated the significance of the combination of how old the participants were and their frailty. In addition, we also might have underestimated their willingness to buy custom-made spectacles and new lamps. Conducting qualitative interviews of the participants in the IG would have highlighted some of these issues, as would interviews with the intervention nurses.

6.5 Implications for practice

Senses such as hearing and vision represent physiological and neurologic connections between a person and the world he/she lives in (56). This means that both hearing and vision are important senses for a person's experience of the world and for his or her well-being. Furthermore, hearing and vision are connected to memory and to the cognitive and intellectual system that stores sensations and information, and enables a person to recognize and experience different phenomena (56). Events that occur in time and space are recognized by the senses, even beyond their original situation, and this is associated with the risk of a person with sensory impairment being mistaken for a person with cognitive impairment. Longitudinal analyses suggest that changes in sensory and intellectual functioning are interrelated (179) and cognitive abilities may also be underestimated if sensory problems are not considered. In this way, people with sensory impairment are at greater risk of cognitive decline. The present study has revealed that it is important to help elderly patients with hearing or vision impairment to recognize the importance of optimizing their own residual hearing and vision, and thereby support social participation. Nurses who provide home care could help the elderly to obtain appropriate aids both hearing aids and custom-made spectacles if needed and optimize the indoor lighting conditions in their homes. The elderly might also need help to start using hearing aids.

People who converse with hearing-impaired persons should be aware of their difficulties, especially with distinguishing high-pitch consonants (see Figure 1), so that they can help hearing-impaired people to understand them and communicate. It is important for the home care nurses to ensure good communication with and provide optimal care to the patient, such as by controlling the functioning of a hearing aid, as well as regularly rinsing it and changing its batteries when required.

Elderly residents of Norway can obtain hearing aids free of charge from aid centers. However, this first requires them to be referred by their GP to a hearing specialist, and then they also have to actually visit the hearing specialist so that their hearing can be checked, and then complete an application for a hearing aid. For this age group it might be preferable for home-care nurses to check both their functional hearing and vision using standardized methods as well as asking them to self-assess their hearing and vision. However, achieving this requires nurses to be given special training and also the authority to refer patients to specialists if necessary.

It might also be worth considering whether the elderly should get financial support for buying custom-made spectacles if they need them, and to renew their spectacles as their vision changes with age.

The environment greatly influences self-care, and Orem et al. (95) argue that nurses need to create a therapeutic environment. Good lighting conditions in the home could be a basic requisite for elderly people to be able to manage everyday life (21, 23, 180). The present study found that the lighting conditions of the elderly participants were far below the recommended lux values (Paper III). Since the aging eye takes longer to adapt to changes in the light intensity in the visual field, large variations of the illumination in a room will result in the eye taking longer time to adapt to the areas where the illumination is strongest and weakest (18). This increases the danger of stumbling and falling when elderly people with vision impairment move in a room that has large variations in illumination, such as in a generally dark room with only one reading light beside the chair where the elderly person normally sits. The lighting conditions in different rooms also need to be adapted appropriately to the needs of the elderly (3). Lamps with dark shades, heavy and dark curtains, and plants in

the window can reduce both daylight and artificial light (15, 181), and should therefore be avoided.

The home-care services provided in Norway differ markedly between municipalities. Some municipalities include Preventive Home Visits, which are health services that aim to promote older persons' health, prevent functional decline, and reduce the need for comprehensive healthcare (182). Others do not have this service at all. Some municipalities have a hearing and/or a vision contact person, while others do not have this. However, even in municipalities with preventive home visits, it is not customary to consider the indoor lighting conditions. The results from this study provide a reminder of the importance of ensuring adequate indoor lighting conditions for the elderly.

6.6 Implications for future research

This study has produced some important novel findings, but it has also raised some new questions. One important question is how frail elderly may tend to their sensory impairments and start self-monitoring their own hearing and vision from an earlier age.

It is crucially important to look at age-related hearing and vision impairment in context, and thus apply a multidimensional approach to the understanding and practice related to sensory impairment. Interviewing older people about their preferences and involving them in developing age-appropriate interventions might increase the chance of successful interventions. Nurses working in the geriatric field can play a key role, and interventions that provide nurses with extended training programs in this area should be examined. An important aspect of such programs would be to improve their knowledge of the strengths and limitations of self-care in advanced age and how to support older people in their self-care efforts.

Recent research has revealed that visual impairment is particularly associated with low subjective well-being among individuals older than 95 years (183). This also means that the oldest elderly can benefit from optimization of their vision. Drawing on the experiences from this study and other studies (183), it could be useful to perform new intervention studies in different contexts and, on a larger scale, and focusing on different age categories, possibly following up participants for a longer period and offering more help, particularly to the oldest. It might also be possible to develop a home care model where specialists can visit the oldest elderly in their homes.

As this study suggest, the discrepancy between the self-assessments of the participants and their results from standardized tests is a complex question that has several possible interpretations. More research is also needed in order to understand the observed discrepancy better.

7 CONCLUSION

The overall aim of this thesis was to obtain knowledge about the characteristics of hearing and vision impairments among elderly recipients of home care and to determine whether there is consistency between self-assessed and standardized tests of hearing and vision in the elderly. Furthermore, the aim was to measure the effects on an intervention aimed at improving their functional hearing and vision, and the lighting conditions in the home.

The thesis provides a basis to draw the following conclusions:

- Many elderly recipients of home care live with hearing and vision impairments which have not been sufficiently attended to
- When using one global question (Do you consider your hearing/vision to be good, not so good, poor or very poor/deaf/blind?) the elderly rated their hearing and vision as better than the results from the standardized tests
- The ROC analysis revealed that the self-assessment with only one global question is not a valid tool for determining whether hearing and/or vision impairment is present in very old recipients of home care
- When asked more detailed questions about communication and reading several of the elderly reported having difficulties with hearing and/or vision
- Measurement of the indoor lighting in the homes showed that the lighting levels were far below recommended values for elderly
- The indoor lighting levels were significantly improved in the IG by changing light bulbs and using more of the lamps they already had
- The intervention revealed that many elderly could not be expected to do all the self-care activities necessary to improve their functional sensory impairments and/or the indoor lighting conditions themselves. Close monitoring and assistance is recommended

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Appendices

I IPLOS registrering av hørsel og syn

II Råd angående lysforhold i hjemmet

III Henvisning til spesialist

IV KAS Spørreskjema [KAS Screen] (utdrag)

APPENDIX I UTDRAG FRA IPLOS KARTLEGGINGSSKJEMA

Hørsel	Sanse lyd og skille mellom lyders tonehøyde, styrke, egenart og sted. Skille mellom ulike lyder, steds- og sidebestemmelse av lyd, talegjenkjenning.

1. Hører godt/har ingen problemer
2. Har noe redusert hørsel
   Ikke til vesentlig hinder for samtale en til en og i gruppe. Lettere vansker når det ikke er stille i omgivelsene/flere snakker i samme rom. Hører godt med hjelpemidler som høreapparat/hørat og lignende.
3. Har dårlig hørsel
   Hører kun når det blir snakket høyt, klart og tydelig. Har noe problemer selv ved bruk av hjelpemidler som høreapparat/hørat og lignende. Vansker med å føre samtale en til en og i grupper.
4. Har svært dårlig hørsel
   Kan ikke høre verbal kommunikasjon og har store problemer selv ved bruk av høreapparat/hørat og lignende. Må se den som prater.
5. Døv
9. Ikke relevant

Syn	Sanse lys og farge, se størrelse, form og avstand.

1. Ser godt / har ingen problemer
2. Har noe redusert syn
   Ser godt med hjelpemidler som briller, godt lys, evt. lupe ved lesing. Ingen problemer å synsorientere seg i eget hjem eller nye omgivelser.
3. Har dårlig syn
   Kan ikke lese aviser/egen post/innkomne regninger/oppskrifter/bruke redskaper som litermål ol. Kan synsorientere seg i eget hjem og nye omgivelser.
4. Har svært dårlig syn
   Kan ikke lese aviser / egen post / innkomne regninger / oppskrifter / bruke redskaper som litermål ol. Kan synsorientere seg i eget hjem men ikke i nye omgivelser.
5. Blind
9. Ikke relevant

APPENDIX II – Råd angående lysforhold i hjemmet

Høgskolen i Buskerud/Universitetet i Oslo

F: __ __ _____

I forbindelse med en undersøkelse av lysforholdene i ditt hjem anbefales det følgende:

Dersom det er spørsmål vedrørende dette, kan du ta kontakt med:

Gro Gade Haanes
(PHD-stipendiat)

Tlf. 32 206496
Mob. 93437662

APPENDIX III – Henvisning til spesialist

Henvisning

Navn:……

I forbindelse med en undersøkelse av syn og hørsel i kombinasjon med belysning, trivsel og funksjon i eget hjem, har du nå gjennomgått en enkel synstest på avstand og nær, med beste korreksjon.

Da det ble oppnådd litt redusert syn på HØ / VØ / Begge øyne samtidig (strek under det som passer), anbefaler vi at du går til en synsundersøkelse hos optiker eller lege.

Da det ble oppnådd litt redusert hørsel på HØ / VØ / Begge ører samtidig (strek under det som passer), anbefaler vi at du går til en øre- nese- halslege eller til din fastlege.

Til optiker/lege:

Grensen for at vi anbefaler en synsundersøkelse, er oppnådd visus lik eller lavere enn 0,7 på HØ/ VØ / Begge øyne undersøkt samtidig (strek under det som passer).

Grensen for at vi anbefaler en hørselsundersøkelse, er oppnådd hørsel lik eller lavere enn 35 dBHL på HØ/VØ/Begge ører samtidig.

Det kan være greit at du tar med dette skrivet til undersøkelsen.

APPENDIX IV – KAS Spørreskjema [KAS Screen] (utdrag)

UTDRAG FRA KAS SCREENING INSTRUMENT

DEL 1. Bakgrunnsopplysninger

1. **Kjønn:** ☐ Kvinne ☐ Mann

2. **Fødselsår?** ……/……/……/……

3. **Sivil status:**
   - ☐ Gift/samboer
   - ☐ Ugift
   - ☐ Skilt
   - ☐ Enke/-mann

4. **Brukers høyeste fullførte allmennutdannelse?**
   - ☐ 7-årig folkeskole eller mindre
   - ☐ Framhaldsskole (1-2 år)
   - ☐ Realskole, middelskole
   - ☐ Videregående skole (artium)

5. **Har bruker fullført yrkesutdanning (som f. eks. yrkesskole, husmorskole, landbruksskole, handelsskole, landbruksskole, utdanning på universitet eller høgskole)?**
   - ☐ 1-2 års yrkesutdanning
   - ☐ 3-4 års yrkesutdanning
   - ☐ Mer enn 4 års utdanning (universitet og høgskole)
   - ☐ Annet

   ……
   ……

6. **Hva slags yrker har bruker hatt?:**

   ……
   ……

HUSHOLD OG BOLIG

7. Hvilke type hus bor bruker i?:

Svarkategorier:

- ☐ Bor i frittliggende enebolig
- ☐ 2-4 mannsbolig, rekkehus, enebolig i rekke
- ☐ Leilighet i lavblokk
- ☐ Leilighet i annen blokk
- ☐ Annen bolig, f. eks. institusjon

8. Bor bruker alene eller sammen med andre (dvs. i samme bolig med delt husholdning)?

- ☐ Bor alene
- ☐ Bor sammen med andre (dvs. deler husholdning), evt. med hvem? .....
- ☐ Andre bor i samme hus (deler ikke husholdning) .....

9. Bor bruker i bolig som er reservert for eldre eller funksjonshemmede (trygdebolig, servicebolig, omsorgsbolig)? Dersom ja, er den frittliggende eller tilknyttet servicesentra eller institusjon?

Svarkategorier:

- ☐ Nei
- ☐ Ja, frittliggende bolig for eldre/funksjonshemmede
- ☐ Ja, bolig for eldre/funksjonshemmede som er knyttet til servicesenter eller institusjon.
- ☐ Bor i alders- eller sykehjem
- ☐ Annen type bolig reservert eldre .....

11. Omtrent hvor lenge har bruker bodd i den boligen hun/han har nå? ..... år

12. Omtrent hvor lenge har bruker bodd i denne kommunen/bydelen? ..... år

Del 2: Syn OG HØRSEL

1. "*Hvordan vurderer du synet ditt sammenlignet med andre på din alder?*"
(med de brillene eller hjelpemidlene du vanligvis bruker til daglig)

Svarkategorier:

- ☐ Ser godt → gå til spørsmål nr. 5
- ☐ Ser ikke så godt
- ☐ Ser dårlig (svaksynt)
- ☐ Ser svært (dårlig blind)

2. Er synsproblemet medfødt eller har bruker fått det senere i livet?

Svarkategorier:

☐ Medfødt
☐ Ervervet (etter 2 års alder)
☐ Vet ikke

3. Hvis synsproblemet er kommet senere i livet, omtrent hvor lenge er det siden bruker merket vanskene?

Ca. antall år:.....
☐ Vet ikke

4. Diagnose. Er årsaken til synsproblemene kjent for bruker?

Svarkategorier:

☐ Grå stær (Cataract)
☐ Forkalkninger i øyet (Macula degenerasjon)
☐ Grønn stær (Glaucom)
☐ Netthinneskader
☐ Andre årsaker .....
.....
☐ Bruker er ikke kjent med årsaken

5. Har bruker hatt noen medisinsk behandling for synet sitt?

Svarkategorier

☐ Nei
☐ Ja
☐ Vet ikke

Hvis ja, evt. hva slags behandling:.....
.....

6. Mener bruker at synet har endret seg de siste 2–3 årene ?

Svarkategorier:

☐ Synet er blitt bedre
☐ Synet er uforandret
☐ Synet er blitt dårligere

7. Er evt. årsaken(e) til disse endringene kjent for bruker?

Svarkategorier:

☐ Nei

☐ Ja .....

.....

8. Når tok bruker evt. synsprøve siste gang?

Svarkategorier:

☐ I løpet av det siste året
☐ 2 år siden
☐ Det er lengre siden
☐ Ikke undersøkt synet
☐ Vet ikke

9. Hvor ble synsprøven tatt?

.....

.....

10. Går bruker til jevnlig kontroll hos øyelege?

☐ Ja
☐ Nei

11. Brukes briller til daglig ?

☐ Ja
☐ Nei
☐ Delvis

12. Har bruker noen spesielle hjelpemidler for synet, f.eks. lupe, ur, hvit stokk etc. ?

Svarkategorier:

☐ Ja
☐ Nei

Hvis ja, hva slags hjelpemidler ?

☐ Spesialbrille
☐ Lupe
☐ Lese TV
☐ Kassettspiller
☐ Hvit stokk
☐ Klokke
☐ Andre hjelpemidler eller f.eks. ekstra belysning:

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.....

.....

.....

13. Brukes disse hjelpemidlene vanligvis til daglig ?

Svarkategorier:

☐ Ja
☐ Nei
☐ Delvis

14. Er bruker fornøyd med hjelpemidlene?

Svarkategorier:

☐ Ja
☐ Nei, evt. hvorfor ikke .....

☐ Delvis, evt. hvorfor .....

15. Har bruker fått tildelt hjelpemidlene via kommunenes rehabiliteringstjeneste/HMS?

Svarkategorier.

☐ Ja
☐ Nei
☐ Andre
☐ Vet ikke

16. "*Hvordan synes du hørselen din er sammenlignet med andre på din alder*!"
*(med de hjelpemidlene du bruker til daglig)***?**

Svarkategorier:

☐ Hører godt → gå til spørsmål nr. 20
☐ Hører ikke så godt
☐ Hører dårlig (tunghørt)
☐ Hører svært dårlig (døv)

17. Er hørselsproblemet medfødt eller har bruker fått det senere i livet ?

Svarkategorier:

☐ Medfødt
☐ Ervervet (etter ca. 2 års alder)

☐ Vet ikke

18. Hvis hørselsproblemet har kommet senere i livet, omtrent hvor lenge er det siden han/hun merket vanskene?

Ca. antall år .....
☐ Vet ikke

19. Er årsaken til hørselsproblemene kjent for bruker?

Svarkategorier:

☐ Støyskader
☐ Hørselsskade som følge av sykdom .....
☐ Aldersbetinget hørselstap
☐ Andre årsaker
.....
☐ Vet ikke

20. Har bruker hatt noen medisinsk behandling for hørselen sin ?

Svarkategorier:

☐ Nei
☐ Ja
☐ Vet ikke

Hvis ja, evt. hva slags behandling ? .....
.....

21. Mener bruker at hørselen har endret seg de siste 2 årene ?

Svarkategorier:

☐ Hørselen er blitt bedre
☐ Hørselen er uforandret
☐ Hørselen er blitt dårligere

22. Er evt. årsaken(e) til disse endringene kjent for bruker?

Svarkategorier:

☐ Nei
☐ Ja .....
.....

23. Når undersøkte bruker hørselsen siste gang ?

Svarkategorier:

☐ I løpet av det siste året
☐ 2 år siden
☐ Det er lengre siden
☐ Har ikke undersøkt hørselen
☐ Vet ikke

24. Hvor ble evt. hørselsundersøkelsen tatt?

.....

.....

25. Har bruker evt. fått tildelt høreapparat? Brukes det evt. til daglig?

☐Ja
Bruk: .....

.....

☐Nei
Evt. hvorfor ikke: .....

.....

26. Går bruker til jevnlig kontroll hos ØNH-lege/hørselssentral?

Svarkategorier:

☐ Ja
☐ Nei

27. Har bruker noen hjelpemidler for hørselen (utover høreapparat)?

Svarkategorier:

☐ Ja
☐ Nei

Hvis ja, hva slags hjelpemidler ?

☐ Teleslynge
☐ Samtaleforsterker
☐ Forsterker på telefon, telefon for hørselshemmede
☐ Teksttelefon
☐ Varslingsanlegg med vibrator .....
☐ Varslingsanlegg med lys .....
☐ Andre hjelpemidler, f. eks. belysning:

.....

.....

28. Blir vanligvis disse hjelpemidlene brukt til daglig ?

Svarkategorier:

☐ Ja
☐ Nei
☐ Delvis

29. Er bruker fornøyd med hjelpemidlene?

Svarkategorier:

☐ Ja
☐ Nei, evt. hvorfor ikke .....
.....

☐ Delvis, evt. hvorfor .....
.....

30. Har bruker fått tildelt hjelpemidlene via kommunens rehabiliteringstjeneste/HMS?

Svarkategorier:

☐ Ja
☐ Nei
☐ Andre
☐ Vet ikke

Del 3: KOMMUNIKASJON/SOSIALT SAMVÆR:

31. Hvilke samtaleform benyttes/brukes vanligvis ?

Svarkategorier:

☐ Vanlig tale med høreapparat eller samtaleforsterker (strek under det som er aktuelt)
☐ Vanlig tale uten høreapparat eller samtaleforsterker
☐ Tegnspråk
☐ Håndalfabet
☐ Tusjskrift
☐ Skrift i hånd
☐ Annen kommunikasjonsform: .....
.....

32. Hvis tegnspråk eller håndalfabet benyttes, er det andre personer der bruker bor som også behersker dette ?

Svarkategorier:

☐ Ja
☐ Nei

33. *"Synes du at folk flest snakker for lavt, for fort eller for utydelig ?"*

Svarkategorier:

☐ Nei
☐ Nei, i liten grad
☐ Ja, av og til
☐ Ja, ofte

34. *"Har du vanligvis problemer med å forstå hva andre sier ?"*

Svarkategorier:

☐ Nei
☐ Nei, i liten grad
☐ Ja, av og til
☐ Ja, ofte

35. *"Synes du at hørselen hemmer deg i samtale med en kjent person når det ellers er rolig rundt dere ?"*

Svarkategorier:

☐ Nei
☐ Nei, i liten grad
☐ Ja, av og til
☐ Ja, ofte

36. *"Er det vanskelig å oppfatte hva som blir sagt når det er mange tilstede, f.eks. i selskap ?"*

Svarkategorier:

☐ Nei
☐ Nei, i liten grad
☐ Ja, av og til
☐ Ja, ofte

37. ***"Er det vanskelig å forstå hva som blir sagt når du snakker i telefonen ?"***

Svarkategorier:

☐ Nei
☐ Nei, i liten grad
☐ Ja, av og til
☐ Ja, ofte

38. ***"Synes du det er vanskelig å oppfatte hva som blir sagt når det snakkes en annen dialekt enn det du er vant til ?"***

Svarkategorier:

☐ Nei
☐ Nei, i liten grad
☐ Ja, av og til
☐ Ja, ofte

39. ***"Skaper hørselen problemer når du møter nye (ukjente) mennesker ?"***

Svarkategorier:

☐ Nei
☐ Nei, i liten grad
☐ Ja, av og til
☐ Ja, ofte

40. ***"Er det nødvendig å se på ansiktet til vedkommende for å få støtte til å oppfatte det som sies ?"***

Svarkategorier:

☐ Nei
☐ Nei, i liten grad
☐ Ja, av og til
☐ Ja, ofte
☐ Ser ikke godt nok til slik støtte

41. ***"Er det på grunn av synet vanskelig å gjenkjenne personer du tilfeldig møter eller som kommer uventet på besøk ?"***

Svarkategorier:

☐ Nei
☐ Vanligvis ikke
☐ Ja, av og til
☐ Ja, ofte

41. ***"Ser du godt nok til å skrive f.eks. skrive eget navnetrekk, notater etc. når du har behov for det ?"***

Svarkategorier:

☐ Ja, det går greit
☐ Det er av og til vanskelig
☐ Det er svært vanskelig
☐ Nei, jeg ser ikke å skrive

42. Hvis det er vanskelig å skrive, brukes da en annen skriftform, f.eks. punktskrift ?

Svarkategorier:

☐ Nei
☐ Ja Evt. hvilke.....
.....

Del 4: TILGANG PÅ INFORMASJON

45. ***"Leser du avisoverskriftene og annen stor skrift ?"***

Svarkategorier:

☐ Ja, det går greit
☐ Det er av og til vanskelig
☐ Det er svært vanskelig
☐ Nei, jeg kan ikke lese avisoverskrifter

46. ***"Leser du vanlig avisskrift?"***

Svarkategorier:

☐ Ja, det går greit
☐ Det er av og til vanskelig
☐ Det er svært vanskelig
☐ Nei, jeg kan ikke lese vanlig avistrykk

47. ***"Leser du også svært liten skrift*** *(f. eks. skriften på et medisinglass)?"*

Svarkategorier:

☐ Ja, det går greit
☐ Det er av og til vanskelig
☐ Det er svært vanskelig
☐ Nei, jeg kan ikke

48. ***"Synes du det er anstrengende å lese?"***

Svarkategorier:

☐ Nei, vanligvis ikke
☐ Ja, ofte

49. ***"Kan du oppfatte tekst og bilder på TV?"***

Svarkategorier:

☐ Ja, det går greit
☐ Det er av og til vanskelig
☐ Det er svært vanskelig
☐ Nei, kan ikke se på TV skjermen

50. ***"Kan du høre det som blir sagt i radio, fra TV eller på kassettspiller når det ellers er rolig rundt deg ?"***

Svarkategorier:

☐ Nei
☐ Nei, i liten grad
☐ Ja, av og til
☐ Ja, ofte

51. ***"Kan du høre når dørklokken din ringer eller at det banker på døren din?"***

Svarkategorier:

☐ Nei

☐ Nei, i liten grad
☐ Ja, av og til
☐ Ja, ofte

52. ***"Har du noe problem å høre brannvarsler og evt. annet alarmsystem el. vekkeklokke?"***

Svarkategorier:

☐ Nei
☐ Nei, i liten grad
☐ Ja, av og til
☐ Ja, ofte

53. ***"Kan du følge med på hvor mye klokken er?"***

Svarkategorier:

☐ Ja, jeg ser (eller hører) hva klokken er
☐ Ja, stort sett går det greit å se (eller høre) hva klokken er
☐ Det er av og til vanskelig
☐ Jeg kan ikke se (eller høre) den /de klokkene jeg har.